The Department of Defense

Small Business Technology Transfer (STTR)

FY 1998

PROGRAM SOLICITATION
Closing Date: 15 APRIL 1998

Department of the Army

Department of the Navy

Department of the Air Force

BMDO Ballistic Missile Defense Organization

DARPA Defense Advanced Research Projects Agency

PROGRAM SOLICITATION

Number 98

Small Business Technology Transfer (STTR) Program

IMPORTANT

The DoD updates its SBIR/STTR Mailing list annually. To remain on the mailing list or to be added to the list, send in the Mailing List form (Reference E), found at the back of this solicitation or complete the electronic form at http://www.teltech.com/sbir/form.html. Failure to send in the form annually will result in removal of your name from the mailing list.

If you have questions about the Defense Department's STTR program, please call the SBIR/STTR Help Desk at (800) 382-4634, or see the DoD SBIR/STTR Home Page, at http://www.acq.osd.mil/sadbu/sbir.

U.S. Department of Defense
STTR Program Office
Washington, DC 20301

Opening Date: December 1, 1997
Closing Date: April 15, 1998

Deadline for receipt of proposals at the DoD Component is 2:00 p.m. local time.

OFFICE OF THE UNDER SECRETARY OF DEFENSE

ACQUISITION AND
TECHNOLOGY

IMPORTANT NEW FEATURES OF THE DEFENSE DEPARTMENT'S STTR PROGRAM

This solicitation reflects a number of important changes in the Defense Department's STTR program that have been implemented over the past two years. The purpose of these changes is (1) to make the program more user-friendly to small firms and their research institution partners, and (2) to increase commercialization of STTR research in military and/or private sector markets. The main changes, which have also been implemented in the Department's Small Business Innovation Research (SBIR) program, are as follows:

1. **The Department has streamlined the processing of applications under the STTR "Fast Track," and made other significant improvements in the Fast Track policy.** Under the Fast Track policy, STTR projects that attract matching cash from an outside investor for their Phase II effort have an opportunity to (1) receive interim funding between Phases I and II; (2) be evaluated for Phase II award under a separate, expedited process; and (3) be selected for Phase II award provided they meet or exceed a threshold of "technically sufficient" and have substantially met their Phase I technical goals (and assuming other programmatic factors are met). Consistent with DoD policy, this process should prevent any significant gaps in funding between Phases I and II for Fast Track projects, and result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects. The purpose of the Fast Track is to focus STTR funding on those projects that are most likely to be developed into viable new products that DoD and others will buy and that will thereby make a major contribution to U.S. military and/or economic capabilities. See Section 4.5 of this solicitation for complete information on the revised Fast Track policy and how to participate.

2. **The Department's SBIR/STTR Help Desk** can address your questions about this solicitation, the proposal preparation process, contract negotiation, payment vouchers, government accounting requirements, intellectual property protection, the Fast Track, obtaining outside financing, and other program-related areas. You may contact the Help Desk by:

   - Phone: 800-382-4634 (8AM to 8PM EST)
   - Fax: 800-462-4128
   - Email: SBIRHELP@us.teltech.com

3. **The SBIR/STTR Home Page (http://www.acq.osd.mil/sadbu/sbir)** offers electronic access to answers to commonly-asked questions, sample proposals, model contracts, abstracts of ongoing STTR and SBIR projects, early releases of the STTR and SBIR solicitations, the latest updates on the DoD STTR and SBIR programs, hyperlinks to sources of business assistance and financing, and other useful information.

4. **You may contact the DoD authors of solicitation topics to ask questions about the topics** before you submit a proposal. Procedures for doing so are discussed in Section 1.5(c) of this solicitation. Please note that, to ensure competitive fairness, you may talk by telephone with a topic author to ask such questions only during the six weeks preceding the date on which the solicitation officially opens. At other times, you may submit written questions, and all such questions and the responses will be posted electronically on the Internet for general viewing.

5. **All companies submitting a Phase I or Phase II proposal must complete a Company Commercialization Report (Appendix E)** -- a simplified listing of the commercialization status of the company's prior Phase II efforts (see Section 3.4(n)).

6. **An STTR proposal that meets the goals of a solicitation topic but does not use the exact approach specified in the topic will still be considered.** For further information on this new Department policy, see Section 4.1 of this solicitation.

7. **The Department has significantly reduced delays in the SBIR and STTR proposal evaluation and contracting process.** The median time between proposal receipt and award is now less than 4 months in Phase I and approximately 7 months in Phase II. We are working to further reduce the processing time in Phase II.

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DOD PROGRAM SOLICITATION FOR SMALL BUSINESS TECHNOLOGY TRANSFER

1.0 PROGRAM DESCRIPTION

1.1 Introduction

The Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), and Ballistic Missile Defense Organization (BMDO), hereafter referred to as DoD Components, invite small business firms and research institutions to jointly submit proposals under this solicitation for the Small Business Technology Transfer (STTR) program. The STTR Program is a pilot program under which awards are made to small business concerns for cooperative research and development, conducted jointly by a small business and a research institution, through a uniform process having three phases. STTR, although modeled substantially on the Small Business Innovation Research (SBIR) Program, is a separate program and is separately financed. Subject to availability of funds, DoD Components will support high quality cooperative research and development proposals of innovative concepts to solve the listed defense-related scientific or engineering problems, especially those concepts that also have high potential for commercialization in the private sector.

The STTR Program is designed to provide a strong incentive for small companies and researchers at research institutions, i.e., non-profit research institutions, contractor-operated federally funded research and development centers (FFRDCs), and universities, to work together as a team to move ideas from the research institution to the marketplace, to foster high-tech economic development, and to address the technological needs of our armed forces. (See Reference F)

Partnerships between small businesses and Historically Black Colleges or Universities (HBCUs) or Minority Institutions (MIs) are encouraged, although no special preference will be given to STTR proposals from such offerors.

The Federal STTR Program is mandated by Public Law 102-564. The basic design of the DoD STTR Program is in accordance with the Small Business Administration (SBA) STTR Policy Directive of 1993. The DoD Program presented in this solicitation strives to encourage scientific and technical innovation in areas specifically identified by DoD Components. The guidelines presented in this solicitation incorporate and exploit the flexibility of the SBA Policy Directive to encourage proposals based on scientific and technical approaches most likely to yield results important to DoD and the private sector.

1.2 Three Phase Program

This program solicitation is issued pursuant to the Small Business Research and Development Enhancement Act of 1992, PL 102-564. Phase I is to determine the scientific, technical and commercial merit and feasibility of the proposed cooperative effort and the quality of performance of the small business concern with a relatively small investment before consideration of future DoD support in Phase II. Several different proposed solutions to a given topic may be funded. Proposals will be evaluated on a competitive basis giving primary consideration to the scientific and technical merit of the proposal along with its potential for commercialization. Phase I awards are typically $60,000 to $100,000 in size over a period not to one year.

Subsequent Phase II awards will be made to firms on the basis of results of their Phase I effort and the scientific, technical merit and commercial potential of their Phase II proposal. Phase II awards are typically $400,000 to $500,000 in size over a period generally not to exceed 24 months (subject to negotiation). Phase II is the principal research or research and development effort and is expected to produce a well-defined deliverable product or process.

Under Phase III, the small business is expected to use non-federal capital to pursue private sector applications of the research or development. Also, under Phase III, federal agencies may award non-STTR funded follow-on contracts for products or processes which meet the mission needs of those agencies.

DoD is not obligated to make any awards under either Phase I, II, or III. DoD is not responsible for any monies expended by the proposer before award of any contract.

1.3 Eligibility and Limitation

Each proposer must qualify as a small business for research or research and development purposes as defined in Section 2.3 and certify to this on the Cover Sheet (Appendix A) of the proposal. In addition, a minimum of 40 percent of each STTR project must be carried out by the small business concern and a minimum of 30 percent of the effort performed by the research institution, as defined in Section 2.4. The percent of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their DoD contracting officer during contract negotiations.

A small business concern must negotiate a written agreement between the small business and the research institution allocating intellectual property rights and rights to carry out follow-on research, development, or commercialization (see Reference A).

At the time of award of a Phase I or Phase II contract, the small business concern must have at least one employee in a management position whose primary employment is with the small business and who is not also employed by the research institution. Primary employment means that more than one half of the employee's time is spent with the small business.

For both Phase I and Phase II, the research or research and development work must be performed by the small business concern and research institution in the United States. "United States" means the fifty states, the Territories and possessions of the United States, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, the Trust Territory of the Pacific Islands, and the District of Columbia.

Joint ventures and limited partnerships are permitted for the small business portion, provided that the entity created qualifies as a small business in accordance with the Small Business Act, 15 USC 631, and the definition included in Section 2.3.

1.4 Conflicts of Interest

Awards made to firms owned by or employing current or previous Federal Government employees could create conflicts of interest for those employees in violation of 18 USC and 10 USC 2397. Such proposers should contact the cognizant Ethics Counselor from the employees' Government agency for further guidance.

1.5 Questions about STTR and Solicitation Topics

a. General Questions/Information. The DoD SBIR/STTR Help Desk is prepared to address general questions about this solicitation, the proposal preparation process, contract negotiation, payment vouchers, Government accounting requirements, intellectual property protection, the Fast Track, financing strategies, and other program-related areas. The Help Desk may be contacted by:

Phone: 800-382-4634 (8AM to 8PM EST)
Fax: 800-462-4128
Email: SBIRHELP@us.teltech.com

The DoD SBIR/STTR Home Page offers electronic access to answers to commonly asked questions, sample SBIR proposals, model SBIR contracts, abstracts of ongoing SBIR and STTR projects, early releases of the SBIR and STTR solicitations, the latest updates on the SBIR and STTR programs, hyperlinks to sources of business assistance and financing, and other useful information.

DOD SBIR/STTR HOME PAGE:
http://www.acq.osd.mil/sadbu/sbir

b. General Questions About a DoD Component. General questions pertaining to a particular DoD Component (Army, Navy, Air Force, etc) should be submitted in accordance with the instructions given at the beginning of that Component's topics, in Section 8.0 of this solicitation.

c. Technical questions about solicitation topics. Approximately six weeks before this solicitation officially opens on December 1, 1997, the solicitation topics are released electronically on the DoD SBIR/STTR Home Page (**http://www.acq.osd.mil/sadbu/sbir**), along with the names of the topic authors and their phone numbers. This early release gives proposers an opportunity to ask technical questions about specific solicitation topics by telephone before the solicitation opens.

Once a solicitation opens, telephone questions will no longer be accepted, but proposers may submit written questions through the SBIR/STTR Interactive Topic Information System (SITIS), in which the questioner and respondent remain anonymous and all questions and answers are posted electronically for general viewing. Proposers may submit written questions to SITIS via internet (see shortcut bar at the top of the DoD SBIR/STTR Home Page), e-mail, fax, mail, or telephone as follows:

Defense Technical Information Center
MATRIS Office, DTIC-AM
ATTN: SITIS Coordinator
53355 Cole Road
San Diego, CA 92152-7213
Phone: (619) 553-7006
Fax: (619) 553-7053
E-mail: sbir@dticam.dtic.mil
WWW: http://dticam.dtic.mil/sttr/

The SITIS service for this solicitation opens on or around October 20, 1997 and closes to new questions on March 15, 1998. SITIS will post all questions and answers on the Internet (see shortcut bar at the top of the DoD SBIR/STTR Home Page) from October 20, 1997 through April 15, 1998. (Answers will also be emailed or faxed directly to the inquirer if the inquirer provides an e-mail address or fax number.) Answers are generally posted within seven working days of question submission.

1.6 Requests for Copies of DoD STTR Solicitation

To remain on the DoD Mailing list for the SBIR and STTR solicitations, send in the Mailing List form (Reference G). You may also order additional copies of this solicitation from:

DoD SBIR Support Services
2850 Metro Drive, Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

The DoD SBIR and STTR solicitations can also be accessed via internet through the DoD SBIR / STTR Home Page at **http://www.acq.osd.mil/sadbu/sbir**.

1.7 SBIR/STTR Conferences and Outreach

The DoD holds three National SBIR/STTR Conferences a year and participates in many state-organized conferences for small business. For information on these events, see our Home Page (**http://www.acq.osd.mil/sadbu/sbir**). We have a special outreach effort to socially and economically disadvantaged firms.

2.0 DEFINITIONS

The following definitions apply for the purposes of this solicitation:

2.1 Research or Research and Development. Systematic study and experimentation directed toward greater knowledge or understanding of the subject studied or toward applying new knowledge to meet a recognized need.

2.2 Cooperative Research and Development. For the purposes of the STTR Program this means research and development conducted jointly by a small business concern and a research institution in which not less than 40 percent of the work is performed by the small business concern, and not less than 30 percent of the work is performed by the research institution. The percent of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their DoD contracting officer during contract negotiations.

2.3 Small Business Concern. A small business concern is one that, at the time of award of a Phase I or Phase II contract:

a. Is independently owned and operated and organized for profit, is not dominant in the field of operation in which it is proposing, and has its principal place of business located in the United States;

b. Is at least 51% owned, or in the case of a publicly owned business, at least 51% of its voting stock is owned by United States citizens or lawfully admitted permanent resident aliens;

c. Has, including its affiliates, a number of employees not exceeding 500, and meets the other regulatory requirements found in 13 CFR Part 121. Business concerns, other than investment companies licensed, or state development companies qualifying under the Small Business Investment Act of 1958, 15 USC 661, et seq., are affiliates of one another when either directly or indirectly (1) one concern controls or has the power to control the other; or (2) a third party or parties controls or has the power to control both. Control can be exercised through common ownership, common management, and contractual relationships. The term "affiliates" is defined in greater detail in 13 CFR Sec. 121.103. The term "number of employees" is defined in 13 CFR 121.106. Business concerns include, but are not limited to, any individual, partnership, corporation, joint venture, association or cooperative.

2.4 Research Institution. Any organization that is:

a. A university.

b. A nonprofit institution as defined in section 4(5) of the Stevenson-Wydler Technology Innovation Act of 1980.

c. A contractor-operated federally funded research and development center, as identified by the National Science Foundation in accordance with the government-wide Federal Acquisition Regulation issued in accordance with section 35(c)(1) of the Office of Federal Procurement Policy Act. (See Appendix F for a list of eligible FFRDCs.)

2.5 Socially and Economically Disadvantaged Small Business. A small business that is at the time of award of a Phase I or Phase II contract:

a. At least 51% owned by an Indian tribe or a native Hawaiian organization, or one or more socially and economically disadvantaged individuals, and

b. Whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals.

A socially and economically disadvantaged individual is defined as a member of any of the following groups: Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent-Asian Americans, or other groups designated by SBA to be socially disadvantaged.

2.6 Women-Owned Small Business. A small business concern that is at least 51% owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

2.7 Funding Agreement. Any contract, grant, or cooperative agreement entered into between any federal agency and any small business concern for the performance of experimental, developmental, or research work funded in whole or in part by the federal government. *Only the contract method will be used by DoD components for all STTR awards.*

2.8 Subcontract. A subcontract is any agreement, other than one involving an employer-employee relationship, entered into by a Federal Government contract awardee calling for supplies or services required solely for the performance of the original contract. This includes consultants.

2.9 Commercialization. The process of developing a product or non-R&D service for sale (whether by the originating party or by others) in government and/or private sector markets.

2.10 HBCU/MI. A list of the Historically Black Colleges and Universities (HBCU) and Minority Institutions (MI) is available through DTIC at 800-363-7247 or via Internet at http://www.acq.osd.mil/ddre/edugate/hbcumi.html.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.1 Proposal Requirements

A proposal to any DoD Component under the STTR Program is to provide sufficient information to persuade the DoD Component that the proposed work represents an innovative approach to the investigation of an important scientific or engineering problem and is worthy of support under the stated criteria.

The quality of the scientific, technical or commercial content of the proposal will be the principal basis upon which proposals will be evaluated. The proposed research or research and development must be responsive to the chosen topic. Any small business contemplating a bid for work on any specific topic should determine that (a) the technical approach has a reasonable chance of meeting the topic objective, (b) this approach is innovative, not routine, and (c) the firm and research institution team have the capability to implement the technical approach, i.e. have or can obtain people and equipment suitable to the task.

It should be recognized that while the STTR Program requires a small business and a research institution to undertake a project cooperatively, the Federal contract is with the small business. The small business, and not the research institution, is to provide satisfactory evidence that it will exercise management direction and control of the performance of the STTR funding agreement. Regardless of the proportion of the work or funding of each of the performers under the contract, the small business is to be primary contractor with overall responsibility for its performance.

Those responding to this solicitation should note the proposal preparation tips listed below:

- Read and follow all instructions contained in this solicitation.
- Use the technical information services from DTIC and other information assistance organizations (Section 7.1 - 7.3).
- Mark proprietary information as instructed in Section 5.6.
- Limit your proposal to 25 pages (excluding company commercialization report).
- Have an agreement between the small business and research institution in place prior to proposal submission (see Section 3.4.o and Reference A).
- Use a type size no smaller than 12 pitch or 11 point.
- Don't include proprietary or classified information in the project summary (Appendix B).
- Include a Copy of Appendix A, Appendix B and Appendix E as part of the Original of each proposal. (Additional copies of all Appendices can be downloaded from http://www.acq.osd.mil/sadbu/sbir.)
- Do not use a proportionally spaced font on Appendix A and Appendix B.

3.2 Proprietary Information

If information is provided which constitutes a trade secret, proprietary, commercial or financial information, confidential personal information, or data affecting the national security, it will be treated in confidence to the extent permitted by law, provided it is clearly marked in accordance with Section 5.6.

3.3 Limitations on Length of Proposal

This solicitation is designed to reduce the investment of time and cost to small firms in preparing a formal proposal. Those who wish to respond must submit a direct, concise, and informative research or research and development proposal of no more than 25 pages, excluding Company Commercialization Report (Appendix E), (no type smaller than 11 point or 12 pitch on standard 8½" X 11" paper with one (1) inch margins, 6 lines per inch), *including Proposal Cover Sheet (Appendix A), Project Summary (Appendix B), Cost Proposal (Appendix C), and any enclosures or attachments.* Promotional and non-project related discussion is discouraged. Cover all items listed below in Section 3.4 in the order given. The space allocated to each will depend on the problem chosen and the principal investigator's approach. In the interest of equity, proposals in excess of the 25-page limitation (including attachments, appendices, or references, but excluding Company Commercialization Report (Appendix E)) will not be considered for review or award.

3.4 Phase I Proposal Format

All pages shall be consecutively numbered and the ORIGINAL of each proposal must contain a completed copy of Appendix A, Appendix B and Appendix E. These appendices must contain all required signatures in order for the proposal to be considered for award. Through the signature of the Corporate Official of the small business concern and the signature of the appropriate official of the research institution on Appendix A, the small business concern AND the research institution certify jointly that:

(1) The proposing firm meets the definition of small business concern found in section 2.3, the proposing institution meets the definition of research institution found in section 2.4, and the proposed STTR project meets the definition of cooperative research and development as defined in section 2.2, and

(2)Regardless of the proportion of the proposed project to be performed by each party, the small business concern will be the primary party that will exercise management direction and control of the performance of the STTR award.

(3) At the time of award, the small business concern will have at least one employee in a management position whose primary employment is with the small business and who is not also employed by the research institution.

If the research institution is a contractor-operated Federally funded research and development center, the appropriate official signing for the contractor-operated Federally funded research and development center certifies additionally that it:

(4) Is free from organizational conflicts of interests relative to the STTR program;
(5) Did not use privileged information gained through work performed for an STTR agency or private access to STTR agency personnel in the development of this STTR proposal; and
(6) Used outside peer review as appropriate, to evaluate the proposed project and its performance therein.

a. Cover Sheet. Complete Appendix A, photocopy the completed form, and use a copy as Page 1 of each additional copy of your proposal.

b. Project Summary. Complete Appendix B, photocopy the completed form, and use a copy as Page 2 of each additional copy of your proposal. The technical abstract should include a brief description of the project objectives and description of the effort. Anticipated benefits and commercial applications of the proposed research or research and development should also be summarized in the space provided. Project Summaries of proposals selected for award will be publicly released on the internet and, therefore, should not contain proprietary or classified information.

c. Identification and Significance of the Problem or Opportunity. Define the specific technical problem or opportunity addressed and its importance. (Begin on Page 3 of your proposal.)

d. Phase I Technical Objectives. Enumerate the specific objectives of the Phase I work, including the questions it will try to answer to determine the feasibility of the proposed approach.

e. Phase I Work Plan. Provide an explicit, detailed description of the Phase I approach. The plan should indicate what is planned, how and where the work will be carried out, a schedule of major events, and the final product to be delivered. Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal.

f. Related Work. Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must persuade reviewers of the proposer's awareness of the state-of-the-art in the specific topic.

Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number), and (3) date of completion.

g. Relationship with Future Research or Research and Development.

(1) State the anticipated results of the proposed approach if the project is successful.
(2) Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort.

h. Commercialization Strategy. Describe, in approximately one page, your company's strategy for converting your proposed STTR research into a product or non-R&D service with widespread commercial use in private sector and/or military markets.

i. Key Personnel. Identify key personnel who will be involved in the Phase I effort including information on directly related education and experience. A concise resume of the principal investigator, including a list of relevant publications (if any), must be included.

j. Facilities/Equipment. Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Items of equipment to be purchased (as detailed in Appendix C) shall be justified under this section. Also state whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name) and local governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

k. Subcontractors/Consultants. All subcontractors, including the research institution partner, must be identified and described according to the guidelines in Appendix C. The STTR program may only make awards to small businesses; therefore, the research institution must have a subcontracting arrangement with the small business. More than one subcontractor is allowed; however, the small business must perform at least 40% of the effort and the research institution listed on Appendix A must perform at least 30% of the work. Subcontractor costs must be detailed at the same level as prime

contractor costs in accordance with Appendix C (in regards to labor, travel, equipment, etc.). If consultants are involved, such involvement should be described in detail and identified in Appendix C.

l. Prior, Current, or Pending Support of Similar Proposals or Awards. *Warning* -- While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

If a proposal submitted in response to this solicitation is substantially the same as another proposal that has been funded, is now being funded, or is pending with another federal agency or DoD Component or the same DoD Component, the proposer must so indicate on Appendix A and provide the following information:

(1) Name and address of the federal agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.
(2) Date of proposal submission or date of award.
(3) Title of proposal.
(4) Name and title of principal investigator for each proposal submitted or award received.
(5) Title, number, and date of solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.
(6) If award was received, state contract number.
(7) Specify the applicable topics for each STTR proposal submitted or award received.

Note: If Section 3.4.l does not apply, state in the proposal "No prior, current, or pending support for proposed work."

m. Cost Proposal. Complete the cost proposal in the form of Appendix C for the Phase I effort only. Some items of Appendix C may not apply to the proposed project. If such is the case, there is no need to provide information on each and every item. What matters is that enough information be provided to allow the DoD Component to understand how the proposer plans to use the requested funds if the contract is awarded.

(1) List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
(2) Special tooling and test equipment and material cost may be included under Phases I and II. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the government or acquired with government funds will be vested with the DoD Component, unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DoD Component.
(3) Cost for travel funds must be justified and related to the needs of the project.
(4) Cost sharing is permitted for proposals under this solicitation; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a proposal.

n. Company Commercialization Report. All small business concerns submitting a Phase I or Phase II proposal must complete Appendix E (Company Commercialization Report), listing the commercialization status of the concern's prior Phase II STTR or SBIR efforts.

This required proposal information shall not be counted toward proposal pages count limitations. A report showing that a small business concern has received no prior Phase II awards will not affect the concern's ability to obtain an STTR award.

o. Agreement between the Small Business and Research Institution. The small business must negotiate a written agreement with the research institution allocating intellectual property rights and rights, if any, to carry out follow-on research, development, or commercialization. The agreement must be finalized and signed by both parties no later than 15 days after the small business receives notification that it has been selected for a Phase I STTR award. The small business must submit this agreement to the awarding agency on request and certify in all proposals that the agreement is satisfactory to the small business. The agreement should, as a minimum, state:

(1) specifically the degree of responsibility and ownership of any product, process, or other invention or innovation resulting from the cooperative research. The degree of responsibility shall include responsibility for expenses and liability, and the degree of ownership shall also include the specific rights to revenues and profits.
(2) which party may obtain U.S. or foreign patents or otherwise protect any inventions resulting from the cooperative research.
(3) which party has the right to any continuation of research including non-STTR follow-on awards.

See Reference A for a guideline or model for such an agreement.

The Federal government will not normally be party to any agreement between the small business concern and the

research institution. Nothing in the agreement is to conflict with any provisions setting forth the respective rights of the United States and the small business with respect to intellectual property rights and with respect to any right to carry out follow-on research. All agreements between the small business and the research institution cooperating in the STTR projects, or any business plans reflecting agreements and responsibilities between the parties during the performance of Phase I or II, or for the commercialization of the resulting technology, shall reflect the controlling position of the small business.

3.5 Bindings

Do not use special bindings or cover. Staple the pages in the upper left hand corner of each proposal.

3.6 Phase II Proposal

This solicitation is for Phase I only. A Phase II proposal can be submitted only by a Phase I awardee and only in response to a request from the agency; that is, Phase II is not initiated by a solicitation.

Each proposal must contain a Cover Sheet (Appendix A) and a Project Summary Sheet (Appendix B), and a Company Commercialization Report (Appendix E). In addition, each Phase II proposal must contain a two-page commercialization strategy, addressing the following questions:

(1) What is the first product that this technology will go into?
(2) Who will be your customers, and what is your estimate of the market size?
(3) How much money will you need to bring the technology to market, and how will you raise the money?
(4) Does your company contain marketing expertise and, if not, how do you intent to bring that expertise into the company?
(5) Who are your competitors, and what is your price and/or quality advantage over your competitors?

Copies of Appendices along with instructions regarding Phase II proposal preparation and submission will be provided by the DoD Components to all Phase I winners at time of Phase I contract award.

3.7 False Statements

Knowingly and willfully making any false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both.

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Introduction

Phase I proposals will be evaluated on a competitive basis and will be considered to be binding for six (6) months from the date of closing of this solicitation unless offeror states otherwise. If selection has not been made prior to the proposal's expiration date, offerors will be requested as to whether or not they want to extend their proposal for an additional period of time. Proposals meeting stated solicitation requirements will be evaluated by scientists or engineers knowledgeable in the topic area. Proposals will be evaluated first on their relevance to the chosen topic. A proposal that meets the goals of a solicitation topic but does not use the exact approach specified in the topic will be considered relevant. (Prospective proposers should contact the topic author as described in Section 1.5 to determine whether submission of such a proposal would be useful.)

Proposals found to be relevant will then be evaluated using the criteria listed in Section 4.2. Final decisions will be made by the DoD Component based upon these criteria and consideration of other factors including possible duplication of other work, and program balance. A DoD Component may elect to fund several or none of the proposed approaches to the same topic. In the evaluation and handling of proposals, every effort will be made to protect the confidentiality of the proposal and any evaluations. There is no commitment by the DoD Components to make any awards on any topic, to make a specific number of awards or to be responsible for any monies expended by the proposer before award of a contract.

For proposals that have been selected for contract award, a Government Contracting Officer will draw up an appropriate contract to be signed by both parties before work begins. Any negotiations that may be necessary will be conducted between the offeror and the Government Contracting Officer. It should be noted that only a duly appointed contracting officer has the authority to enter into a contract on behalf of the U.S. Government.

Phase II proposals will be subject to a technical review process similar to Phase I. Final decisions will be made by DoD Components based upon the scientific and technical evaluations and other factors, including a commitment for Phase III follow-on funding, the possible duplication with other research or research and development, program balance, budget limitations, and the potential of a successful Phase II effort leading to a product of continuing interest to DoD. DoD is not obligated to make any awards under Phase II or the Fast Track, and all awards are subject to the availability of funds. DoD is not responsible for any monies expended by the proposer before award of a contract.

Upon written request and after final award decisions have been announced, a debriefing will be provided to unsuccessful offerors on their proposals.

4.2 Evaluation Criteria - Phase I

The DoD Components plan to select for award those proposals offering the best value to the government and the nation considering the following factors.

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution

b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.

c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Where technical evaluations are essentially equal in merit, cost to the government will be considered in determining the successful offeror.

Technical reviewers will base their conclusions only on information contained in the proposal. It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments. Relevant supporting data such as journal articles, literature, including government publications, etc., should be contained or referenced in the proposal.

4.3 Evaluation Criteria - Phase II

The Phase II proposal will be reviewed for overall merit based upon the criteria below.

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution

b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development by also the ability to commercialize the results.

c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

The reasonableness of the proposed costs of the effort to be performed will be examined to determine those proposals that offer the best value to the government. Where technical evaluations are essentially equal in merit, cost to the government will be considered in determining the successful offeror.

Phase II proposal evaluation may include on-site evaluations of the Phase I effort by Government personnel.

Fast Track Phase II proposals. Under the regular Phase II evaluation process, the above three criteria are each given roughly equal weight (with some variation across the DoD Components). For projects that qualify for the Fast Track (as discussed in Section 4.5), DoD will

evaluate the Phase II proposals under a separate, expedited process in accordance with the above criteria, and will select these proposals for Phase II award provided:

(1) they meet or exceed a threshold of "technically sufficient" for criteria (a) and (b); and
(2) the project has substantially met its Phase I technical goals

(and assuming budgetary and other programmatic factors are met, as discussed in Section 4.1). Fast Track proposals, having attracted matching cash from an outside investor, presumptively meet criterion (c). Consistent with DoD policy, this process should result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects.

4.4 Assessing Commercial Potential of Proposals

A Phase I or Phase II proposal's commercial potential can be evidenced by:

a. The small business concern's record of commercializing STTR, SBIR or other research, particularly as reflected in its Company Commercialization Report (Appendix E).

b. The existence of second phase funding commitments from private sector or non-STTR, non-SBIR funding sources.

c. The existence of third phase follow-on commitments for the subject of the research.

d. The presence of other indicators of commercial potential of the idea, including the proposer's commercialization strategy (discussed in Sections 3.4.h and 3.6, above).

If a proposer chooses to submit a third phase follow-on commitment per (c) above, the commitment should state that the proposer or a third party will provide follow-on funding in Phase III, and indicate the dates on which the funds will be made available. The commitment should also contain specific technical objectives which, if achieved in Phase II, will make the commitment exercisable by the small business. The terms should not be contingent upon the obtaining of a patent due to the length of time this process requires. The funding commitment should be submitted with the Phase II proposal.

4.5 STTR Fast Track

a. In General. On a pilot basis, the DoD STTR program has implemented a streamlined Fast Track process for SBIR projects that attract matching cash from an outside investor for the Phase II STTR effort (as well as for the interim effort between Phases I and II). The purpose is to focus STTR funding on those projects that are most likely to be developed into viable new products that DoD and others will buy and that will thereby make a major contribution to U.S. military and/or economic capabilities.

Outside investors, as defined in DoD's Fast Track Guidance (Reference E), may include such entities as another company, a venture capital firm, an individual investor, or a non-SBIR, non-STTR government program; they do not include the owners of the small business, their family members, and/or affiliates of the small business.

As discussed in detail below, projects that obtain matching funds from outside investors and thereby qualify for the STTR Fast Track will (subject to the qualifications described herein:

(1) Receive interim funding of $30,000 to $50,000 between Phases I and II;
(2) Be evaluated for Phase II award under a separate, expedited process; and
(3) Be selected for Phase II award provided they meet or exceed a threshold of "technically sufficient" and have substantially met their Phase I technical goals (and assuming other programmatic factors are met), as described in Section 4.3.

Consistent with DoD policy, this process should prevent any significant gaps in funding between Phases I and II for Fast Track projects, and result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-fast Track projects.

b. How To Qualify for the STTR Fast Track. To qualify for the STTR Fast Track, a company must submit a Fast Track application at least 60 days prior to completion of its Phase I project, unless a different deadline for Fast Track applications is specified by the DoD component funding the project (see the Component's introductory page in Section 8 of this solicitation). The company is encouraged to discuss the application with its Phase I technical monitor; however, it need not wait for an invitation from the technical monitor to submit either a Fast Track application or a Fast Track Phase II proposal.

A Fast Track application consists of the following items:

(1) A completed Fast Track application form, found at Appendix D. On the application form, the company and its outside investor must:

   (a) State that the outside investor will match both interim and Phase II STTR funding, in cash, contingent on the company's selection for Phase II award, as described on the form at Appendix D. The matching rates needed to qualify for the Fast Track are as follows:

- For companies that have never received a Phase II SBIR or STTR award from DoD or any other federal agency, the minimum matching rate is

25 cents for every STTR dollar. (For Example, if such a company receives interim and Phase II STTR funding that totals $500,000, it must obtain matching funds from the investor of $125,000.)

- For all other companies, the minimum matching rate is 1 dollar for every STTR dollar. (For example, if such a company receives interim and Phase II STTR funding that totals $500,000, it must obtain matching funds from the investor of $500,000.)

(b) Certify that the outside funding proposed in the application qualifies as a "Fast Track investment," and the investor qualifiers as an "outside investor," as defined in DoD Fast Track Guidance (Reference E).

(2) A letter from the outside investor to the company, containing:

(a) A commitment to match both interim and Phase II STTR funding, in cash, contingent on the company's selection for Phase II award, as discussed on the form at Appendix D.

(b) A brief statement (less than one page) describing that portion of the effort that the investor will fund. The investor's funds may pay for additional research and development on the company's STTR project or, alternatively, they may pay for other activities not included in the Phase II contract's statement of work, provided these activities further the development and/or commercialization of the technology (e.g., marketing).

(c) A brief statement (less than one page) describing (i) the investor's experience in evaluating companies' ability to successfully commercialize technology; and (ii) the investor's assessment of the market for this particular STTR technology, and of the ability of the company to bring this technology to market.

(3) A concise statement of work for the interim STTR effort (less than four pages) and detailed cost proposal (less than one page). Note: if the company has already negotiated an interim effort (e.g., an "option") of $30,000 to $50,000 with DoD as part of its Phase I contract, it need only cite that section of its contract, and need not submit an additional statement of work and cost proposal.

The company should send its Fast Track application to its Phase I technical monitor, with copies to the appropriate Component program manager and to the DoD STTR program manager, as indicated on the back of the application form.

Also, in order to qualify for the Fast Track, the company:

(1) Must submit its Phase II proposal no later than 30 days prior to completion of its Phase I contract, unless a different deadline for Fast Track Phase II proposals is specified by the DoD Component funding the contract (see the Component's introductory page in Section 8 of this solicitation).

(2) Must submit its Phase I final report by the deadline specified in its Phase I contract, but not later than 30 days after the completion of the contract.

(3) Must certify, within 45 days after being notified that it has been selected for Phase II award, that the entire amount of the matching funds from the outside investor has been transferred to the company. Certification consists of a letter, signed by both the company and its outside investor, stating that "$_____ in cash has been transferred to our company from our outside investor in accord with the STTR Fast Track procedures." The letter must be sent to the DoD contracting office along with a copy of the company's bank statement showing the funds have been deposited. IMPORTANT: If the DoD contracting office does not receive, within the 45 days, this certification showing the transfer of funds, the company will be ineligible to compete for a Phase II award not only under the Fast Track but also under the regular Phase II competition, unless a specific written exception is granted by the Component's STTR program manager. Before signing the certification letter, the company and investor should read the cautionary note at Section 3.7. If the outside investor is a non-SBIR/non-STTR DoD program, it must provide a line of accounting within the 45 days that can be accessed immediately.

Failure to meet these conditions in their entirety and within the time frames indicated will generally disqualify a company from participation in the STTR Fast Track. Deviations from these conditions must be approved in writing by the contracting office.

c. Benefits of Qualifying for the Fast Track. If a project qualifies for the Fast Track:

(1) It will receive interim STTR funding of $30,000 to $50,000, commencing approximately at the end of Phase I. Note: Consistent with DoD policy, the vast majority of projects that qualify for the Fast Track should receive interim STTR funding. However, the DoD contracting office ahs the discretion and authority, in any particular instance, to deny interim funding when doing so is in the Government's interest

(e.g., when the project no longer meets a military need or the statement of work does not meet the threshold of "technically sufficient" as described in Section 4.3).

(2) DoD will evaluate the Fast Track Phase II proposal under a separate, expedited process, and will select the proposal for Phase II award provided it meets or exceeds a threshold of "technically sufficient" for evaluation criteria (a) and (b), as described in Section 4.3 (assuming budgetary and other programmatic factors are met, as discussed in Section 4.1). Consistent with DoD policy, this process should result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects. However, DoD is not obligated, in any particular instance, to award a Phase II contract to a Fast Track project, and DoD is not responsible for any funds expended by the proposer before award of a contract.

(3) It will receive notification, no later than ten weeks after the completion of its Phase I project, of whether it has been selected for Phase II award.

(4) If selected, it will receive its Phase II award within an average of five months from the completion of its Phase I project.

d. Additional Reporting Requirement. In the company's final Phase II progress report, it must include a brief accounting (in the company's own format) of how the investor's funds were expended to support the project.

5.0 CONTRACTUAL CONSIDERATIONS

Note: Eligibility and Limitation Requirements (Section 1.3) Will Be Enforced

5.1 Awards (Phase I)

a. Number of Phase I Awards. The number of Phase I awards will be consistent with the agency's RDT&E budget, the number of anticipated awards for interim Phase I modifications, and the number of anticipated Phase II contracts. No Phase I contracts will be awarded until all qualified proposals (received in accordance with Section 6.2) on a specific topic have been evaluated. All proposers will be notified of selection/non-selection status for a Phase I award no later than October 15, 1998. The name of those firms selected for awards will be announced. *The DoD Components anticipate making 80 Phase I awards from this solicitation.*

b. Type of Funding Agreement. All winning proposals will be funded under negotiated contracts and may include a fee or profit. The firm fixed price or cost plus fixed fee type contract will be used for all Phase I projects (see Section 5.4). *Note: The firm fixed price contract is the preferred type for Phase I.*

c. Average Dollar Value of Awards. DoD Components will make Phase I awards to small businesses typically on a one-half person-year effort over a period generally not to exceed one year (subject to negotiation). PL 102-564 allows agencies to award Phase I contracts up to $100,000 without justification. The typical size of award varies across the DoD Components; it is therefore important for a proposer to read the introductory page of the Component to which it is applying (in Section 8.0) for any specific instructions regarding award size.

5.2 Awards (Phase II)

a. Number of Phase II Awards. The number of Phase II awards will depend upon the results of the Phase I efforts and the availability of funds. *The DoD Components anticipate that approximately one-third of its Phase I awards will result in Phase II projects.*

b. Type of Funding Agreement. Each Phase II proposal selected for award will be funded under a negotiated contract and may include a fee or profit.

c. Average Dollar Value of Awards. Phase II awards will be made to small businesses based on results of the Phase I efforts and the scientific, technical, and commercial merit of the Phase II proposal. Average Phase II awards will typically cover 2 to 5 person-years of effort over a period generally not to exceed 24 months (subject to negotiation). PL 102-564 states that the Phase II awards may be up to $500,000 each without justification. See special instructions for each DoD Component in Section 8.

5.3 Phase I Report

a. Content. A final report is required for each Phase I project. The report must contain in detail the project objectives, work performed, results obtained, and estimates of technical feasibility. A completed SF 298, "Report Documentation Page", will be used as the first page of the report. In addition, monthly status and progress reports may be required by the DoD agency. (A blank SF 298 is provided in Section 9.0, Reference D.)

b. Preparation.

(1) To avoid duplication of effort, language used to report Phase I progress in a Phase II proposal, if submitted, may be used verbatim in the final report with changes to accommodate results after Phase II proposal submission and modifications required to integrate the final report into a self-contained comprehensive and logically structured document.

(2) Block 12a (Distribution/Availability Statement) of the SF298, "Report Documentation Page" in each unclassified final report must contain one of the following statements:
   (a) Approved for public release; distribution unlimited.
   (b) Distribution authorized to U.S. Government Agencies only; contains proprietary information.

(3) Block 13 (Abstract) of the SF 298, "Report Documentation Page") must include as the first sentence, "Report developed under STTR contract". The abstract must identify the purpose of the work and briefly describe the work carried out, the finding or results and the potential applications of the effort. Since the abstract will be published by the DoD, it must not contain any proprietary or classified data.

(4) Block 14 (Subject Terms) of the SF 298 must include the term "STTR Report".

c. Submission. SIX COPIES of the final report on each Phase I project shall be submitted to the DoD in accordance with the negotiated delivery schedule. Delivery will normally be within thirty days after completion of the Phase I technical effort. One copy of each unclassified report shall be delivered directly to the DTIC, ATTN: Document Acquisition, 8725 John J Kingman Road, Suite 0944, Ft. Belvoir, VA 22060-6218.

5.4 Other Reports

If asked, the contractor will be required to provide DoD with a report during Phase II, and each year for five years after completion of Phase II, detailing: (1) the revenue from sales of new products or non-R&D services resulting from the STTR project, and (2) the sources and amounts of non-STTR, non-SBIR funding received from

the Government and/or private sector sources to further develop the STTR technology.

5.5 Payment Schedule

The specific payment schedule (including payment amounts) for each contract will be incorporated into the contract upon completion of negotiations between the DoD and the successful Phase I or Phase II offeror. Successful offerors may be paid periodically as work progresses in accordance with the negotiated price and payment schedule. Phase I contracts are primarily fixed price contracts, under which monthly payments may be made. The contract may include a separate provision for payment of a fee or profit. Final payment will follow completion of contract performance and acceptance of all work required under the contract. Other types of financial assistance may be available under the contract.

5.6 Markings of Proprietary or Classified Proposal Information

The proposal submitted in response to this solicitation may contain technical and other data which the proposer does not want disclosed to the public or used by the government for any purpose other than proposal evaluation.

Information contained in unsuccessful proposals will remain the property of the proposer except for Appendices A and B. The government may, however, retain copies of all proposals. Public release of information in any proposal submitted will be subject to existing statutory and regulatory requirements.

If proprietary information is provided by a proposer in a proposal which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or data affecting the national security, it will be treated in confidence, to the extent permitted by law, provided this information is clearly marked by the proposer with the term "confidential proprietary information" and provided that the following legend which appears on the title page (Appendix A) of the proposal is completed:

> "For any purpose other than to evaluate the proposal, this data except Appendix A and B shall not be disclosed outside the government and shall not be duplicated, used, or disclosed in whole or in part, provided that if a contract is awarded to the proposer as a result of or in connection with the submission of this data, the government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in page(s)_____ of this proposal"

Any other legend may be unacceptable to the government and may constitute grounds for removing the proposal from further consideration and without assuming any liability for inadvertent disclosure. The government will limit dissemination of properly marked information to within official channels.

In addition, each page of the proposal containing proprietary data which the proposer wishes to restrict must be marked with the following legend:

> "Use or disclosure of the proposal data on lines specifically identified by asterisk (*) are subject to the restriction on the cover page of this proposal."

If all the information on a particular page is proprietary, the proposer should so note by including the word "PROPRIETARY" in both the header and footer on that page.

The government assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

In the event properly marked data contained in a proposal in response to this solicitation is requested pursuant to the Freedom of Information Act, 5 USC 552, the proposer will be advised of such request and prior to such release of information will be requested to expeditiously submit to the DoD Component a detailed listing of all information in the proposal which the proposer believes to be exempt from disclosure under the Act. Such action and cooperation on the part of the proposer will ensure that any information released by the DoD Component pursuant to the Act is properly determined.

Those proposers that have a classified facility clearance may submit classified material with their proposal. Any classified material shall be marked and handled in accordance with applicable regulations. Arbitrary and unwarranted use of this restriction is discouraged. Offerors must follow the Industrial Security Manual for Safeguarding Classified Information (DoD 5220.22M) procedures for marking and handling classified material.

5.7 Copyrights

To the extent permitted by statute, the awardee may copyright (consistent with appropriate national security considerations, if any) material developed with DoD support. DoD receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.

5.8 Patents

Small business firms normally may retain the principal worldwide patent rights to any invention developed with government support. The government receives a royalty-free license for its use, reserves the

right to require the patent holder to license others in certain limited circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. To the extent authorized by 35 USC 205, the government will not make public any information disclosing a government-supported invention for a period of five years to allow the awardee to pursue a patent.

5.9 Technical Data Rights

Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this solicitation generally remain with the contractor, except that the government obtains a royalty-free license to use such technical data only for government purposes during the period commencing with contract award and ending five years after completion of the project under which the data were generated. Upon expiration of the five-year restrictive license, the government has unlimited rights in the STTR data. During the license period, the government may not release or disclose STTR data to any person other than its support services contractors except: (1) For evaluational purposes; (2) As expressly permitted by the contractor; or (3) A use, release, or disclosure that is necessary for emergency repair or overhaul of items operated by the government. See FAR clause 52.227-20, "Rights in Data - SBIR Program" and DFARS 252.227-7018, "Rights in Noncommercial Technical Data and Computer Software -- SBIR Program."

5.10 Cost Sharing

Cost sharing is permitted for proposals under this solicitation; however, cost sharing is not required nor will it be an evaluation factor in the consideration of any Phase I proposal.

5.11 Joint Ventures or Limited Partnerships

Joint ventures and limited partnerships are eligible provided the entity created qualifies as a small business as defined in Section 2.2 of this solicitation.

5.12 Research and Analytical Work

For Phase I and II, a minimum of 40 percent of the research and/or analytical effort must be performed by the proposing firm and a minimum of 30 percent performed by the research institution unless otherwise approved in writing by the contracting officer. The percentage of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their contracting officer during contract negotiations.

5.13 Contractor Commitments

Upon award of a contract, the contractor will be required to make certain legal commitments through acceptance of government contract clauses in the Phase I contract. The outline that follows is illustrative of the types of provisions required by the Federal Acquisition Regulations that will be included in the Phase I contract. This is not a complete list of provisions to be included in Phase I contracts, nor does it contain specific wording of these clauses. Copies of complete general provisions will be made available prior to award.

a. Standards of Work. Work performed under the contract must conform to high professional standards.

b. Inspection. Work performed under the contract is subject to government inspection and evaluation at all reasonable times.

c. Examination of Records. The Comptroller General (or a fully authorized representative) shall have the right to examine any directly pertinent records of the contractor involving transactions related to this contract.

d. Default. The government may terminate the contract if the contractor fails to perform the work contracted.

e. Termination for Convenience. The contract may be terminated at any time by the government if it deems termination to be in its best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.

f. Disputes. Any dispute concerning the contract which cannot be resolved by agreement shall be decided by the contracting officer with right of appeal.

g. Contract Work Hours. The contractor may not require an employee to work more than eight hours a day or forty hours a week unless the employee is compensated accordingly (that is, receives overtime pay).

h. Equal Opportunity. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

i. Affirmative Action for Veterans. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era.

j. Affirmative Action for Handicapped. The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.

k. Officials Not to Benefit. No member of or delegate to Congress shall benefit from the contract.

l. Covenant Against Contingent Fees. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bona fide employees or commercial agencies maintained by the contractor for the purpose of securing business.

m. Gratuities. The contract may be terminated by the government if any gratuities have been offered to any representative of the government to secure the contract.

n. Patent Infringement. The contractor shall report each notice or claim of patent infringement based on the performance of the contract.

o. Military Security Requirements. The contractor shall safeguard any classified information associated with the contracted work in accordance with applicable regulations.

p. American Made Equipment and Products. When purchasing equipment or a product under the STTR funding agreement, purchase only American-made items whenever possible.

5.14 Additional Information

a. General. This Program Solicitation is intended for information purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting STTR contract, the terms of the contract are controlling.

b. Small Business Data. Before award of an STTR contract, the government may request the proposer to submit certain organizational, management, personnel, and financial information to confirm responsibility of the proposer.

c. Proposal Preparation Costs. The government is not responsible for any monies expended by the proposer before award of any contract.

d. Government Obligations. This Program Solicitation is not an offer by the government and does not obligate the government to make any specific number of awards. Also, awards under this program are contingent upon the availability of funds.

e. Unsolicited Proposals. The STTR Program is not a substitute for existing unsolicited proposal mechanisms. Unsolicited proposals will not be accepted under the STTR Program in either Phase I or Phase II.

f. Duplication of Work. If an award is made pursuant to a proposal submitted under this Program Solicitation, the contractor will be required to certify that he or she has not previously been, nor is currently being, paid for essentially equivalent work by an agency of the Federal Government.

g. Classified Proposals. If classified work is proposed or classified information is involved, the offeror to the solicitation must have, or obtain, security clearance in accordance with the Industrial Security Manual for Safeguarding Classified Information (DoD 5220.22M). The Manual is available on-line at http://www.dis.mil or in hard copy from:

Defense Investigative Service
1340 Braddock Place
Alexandria, VA 22314
Phone: (703) 325-5324

6.0 SUBMISSION OF PROPOSALS

An original plus (4) copies of each proposal or modification will be submitted, in a single package, as described below, unless otherwise stated by specific instructions in Section 8.0.

NOTE: THE ORIGINAL OF EACH PROPOSAL MUST CONTAIN A COMPLETED APPENDIX A (COVER SHEET), APPENDIX B (PROJECT SUMMARY), AND APPENDIX E (COMPANY COMMERCIALIZATION REPORT).

6.1 Address

Each proposal or modification thereof shall be submitted in sealed envelopes or packages addressed to the DoD Component address which is identified for the specific topic in that Component's subsection of Section 8.0 of this solicitation.

The name and address of the offeror, the solicitation number, the topic number for the proposal, and the time and date specified for proposal receipt must be clearly marked on the face of the envelope or package. To protect your proposal against rough handling, damage in the mail, and the possibility of unauthorized disclosures, it is recommended that your proposal be double-wrapped and that both the inner and outer envelopes or wrappings be clearly marked.

Offerors using commercial carrier services shall ensure that the proposal is addressed and marked on the outermost envelope or wrapper as prescribed above.

Mailed or handcarried proposals must be delivered to the address indicated for each topic. Secured packaging is mandatory. The DoD Component cannot be responsible for the processing of proposals damaged in transit.

All copies of a proposal must be sent in the same package. Do not send separate information copies or several packages containing parts of the single proposal.

6.2 Deadline of Proposals

Deadline for receipt of proposals at the DoD Component is 2:00 p.m. local time, April 15, 1998. Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before an award is made, and: (a) it was sent by registered or certified mail not later than April 7, 1998 or (b) it was sent by mail and it is determined by the government that the late receipt was due solely to mishandling by the government after receipt at the government installation.

NOTE: There are no other provisions for late receipt of proposals under this solicitation.

The only acceptable evidence to establish (a) the date of mailing of a late-received proposal sent either by registered mail or certified mail is the U. S. Postal Service postmark on the wrapper or on the original receipt from the U. S. Postal Service. If neither postmark shows a legible date, the proposal shall be deemed to have been mailed late. The term postmark means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed on the date of mailing by employees of the U. S. Postal Service. Therefore, offerors should request the postal clerk to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper; (b) the time of receipt at the government installation is the time-date stamp of such installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

Proposals may be withdrawn by written notice or a telegram received at any time prior to award. Proposals may also be withdrawn in person by an offeror or his authorized representative, provided his identity is made known and he signs a receipt for the proposal. (NOTE: the term telegram includes mailgrams.)

Any modification or withdrawal of a proposal is subject to the same conditions outlined above. Any modification may not make the proposal longer than 25 pages (excluding Company Commercialization Report). Notwithstanding the above, a late modification of an otherwise successful proposal which makes its terms more favorable to the government will be considered at any time it is received and may be accepted.

6.3 Notification of Proposal Receipt

Proposers desiring notification of receipt of their proposal must complete and include a self-addressed stamped envelope and a copy of the notification form (Reference B) in the back of this brochure. If multiple proposals are submitted, a separate form and envelope is required for each. Notification of receipt of a proposal by the government does not by itself constitute a determination that the proposal was received on time or not. The determination of timeliness is solely governed by the criteria set forth in Section 6.2.

6.4 Information on Proposal Status

Evaluation of proposals and award of contracts will be expedited, but no information on proposal status will be available until the final selection is made. However, contracting officers may contact any and all qualified proposers prior to contract award.

6.5 Debriefing of Unsuccessful Offerors

Upon written request and after final award decisions have been announced, a debriefing will be provided to unsuccessful offerors for their proposals. The written request should be sent to the DoD organization that notified the proposer that the proposal was not selected for award.

6.6 Correspondence Relating to Proposals

All correspondence relating to proposals should cite the STTR solicitation number and specific topic number and should be addressed to the DoD Component whose address is associated with the specific topic number.

7.0 SCIENTIFIC AND TECHNICAL INFORMATION ASSISTANCE

7.1 DoD Technical Information Services Available

The Defense Technical Information Center (DTIC), provides information service to assist STTR participants in proposal preparation, bid decisions, product development, marketing and networking. The following services are available at no cost to the STTR user.

1. **Public STINET,** DTIC's online technical database is on the DTIC Small Business web site **(http://www.dtic.mil/dtic/sbir).** STTR participants are encouraged to search the database for documents in their areas of interest. Request documents in hard copy by telephone, fax or email.
2. **Full Text Documents** are also on the web site, including a large selection of STTR related technical reports.
3. **ECAB,** an e-mail document alert service available on request to SBIR/STTR participants, is a bimonthly listing of new DTIC accessions that match the recipient's personal interest profile.
4. **Free Reports:** A firm may receive a total of ten hard copy technical reports at no cost from DTIC during a solicitation period. Additional reports, custom bibliographies, and services requested during non-solicitation periods may be charged to a credit card or deposit account.
5. **SITIS,** providing specific technical questions and answers concerning DoD topic descriptions is also on the web site. See the description of SITIS in Section 1.5.c.

DTIC is a major component of the DoD Scientific and Technical Information Program, managing the technical information resulting from DoD-funded research and development. DTIC also manages and provides access to specialized information services and subject matter expertise. MATRIS, a DTIC component, is the focal point for information on manpower, training systems, human performance, and human factors **(http://dticam.dtic.mil).** The DTIC-managed Centers for Analysis of Scientific and Technical Information (the IACs) are the DoD centers of expertise concerned with engineering, technical and scientific documents and databases worldwide **(http://www.dtic.mil/iac/).**

Call, or visit (by pre-arrangement), DTIC at the location most convenient to you. Written communications should be made to the Ft. Belvoir address.

ATTN: DTIC-User Services
Defense Technical Information Center
8725 John J Kingman Rd STE 0944
Ft Belvoir VA 22060-6218
Phone (800) 363-7247
Fax (703) 767-8228
EMail sbir@dtic.mil
WWW http://www.dtic.mil/dtic/sbir

DTIC Boston Regional Office
Building 1103, 5 Wright Street Hanscom AFB
Bedford, MA 01731-5000
(617) 377-2413

DTIC Dayton Regional Office
2690 C Street, Suite 4
Wright Patterson AFB, OH 45433-7411
(513) 255-7905

DTIC Los Angeles Regional Office
222 N. Sepulveda Blvd., Suite 906
El Segundo, CA 90245-4320
(310) 335-4170

DTIC Albuquerque Regional Office
PL/SUL
3550 Aberdeen Ave, SE
Kirtland AFB, NM 87117-6008
(505) 846-6797

7.2 DoD Counseling Assistance Available

Small business firms interested in participating in the STTR Program may seek general administrative guidance from small and disadvantaged business utilization specialists located in various Defense Contract Management activities throughout the continental United States. These specialists are available to discuss general administrative requirements to facilitate the submission of proposals and ease the entry of the small high technology business into the Department of Defense marketplace. The small and disadvantaged business utilization specialists are expressly prohibited from taking any action which would give an offeror an unfair advantage over others, such as discussing or explaining the technical requirements of the solicitation, writing or discussing technical or cost proposals, estimating cost or any other actions which are the offerors responsibility as outlined in this solicitation. (See Reference C at the end of this solicitation for a complete listing, with telephone numbers, of Small and Disadvantaged Business Utilization Specialists assigned to these activities.)

7.3 State Assistance Available

Many states have established programs to provide services to those small firms and individuals wishing to participate in the Federal STTR Program. These services vary from state to state, but may include:

- Information and technical assistance;
- Matching funds to STTR recipients;
- Assistance in obtaining Phase III funding.

Contact your State Government Office of Economic Development for further information.

8.0 TECHNICAL TOPICS

Section 8 contains detailed topic descriptions outlining the technical problems for which DoD Components requests proposals for innovative R&D solutions from small businesses. Topics for each participating DoD Component are listed and numbered separately. Each DoD Component Topic Section contains topic descriptions, addresses of organizations to which proposals are to be submitted, and special instructions for preparing and submitting proposals to organizations within the component. Read and follow these instructions carefully to help avoid administrative rejection of your proposal.

Appendices A, B, C, D and E follow the Component Topic Sections. Appendix A is a Proposal Cover Sheet, Appendix B is a Project Summary form, Appendix C is an outline for the Cost Proposal, Appendix D is the Fast Track Application Form, and Appendix E is the Company Commercialization Report. A copy of Appendix A, Appendix B, and Appendix E must be included with each proposal submitted.

Many of the topics in Section 8 contain references to technical literature or military standards, which may be accessed as follows:

- References with "AD" numbers are available from DTIC, by calling 800/DoD-SBIR or sending an e-mail message to sbir@dtic.dla.mil
- References with "MIL-STD" numbers are available from the DoD Index of Specifications and Standards (DODISS) at Internet address http://www.dtic.mil/dps-phila/dodiss
- Other references can be found in your local library or at locations mentioned in the reference.

ARMY

Submission of Proposals

The responsibility for the implementation, administration, and management of the U.S. Army Small Business Technology Transfer (STTR) Program rests with the Army STTR Program Management Office at the U.S. Army Research Office (ARO). You are invited to submit STTR proposals to ARO at the address below. Proposals must be received at this address no later than the required solicitation closing date and hour.

U.S. Army Research Office
ATTN: STTR-98 (LTC Jones)
P.O. Box 12211
4300 South Miami Blvd.
Research Triangle Park, NC 27709-2211

The Army has identified four technical topics, numbered ARMY 98T001 through ARMY 98T004, to which small businesses and their partner research institutes may respond. Only proposals addressing these topics will be accepted for consideration for Phase I of the STTR Program.

The Army anticipates sufficient funding to allow award of one to three STTR Phase I contracts to firms submitting the highest quality proposals in each topic area. Awards will be made on the basis of technical evaluations using the criteria contained in the solicitation within the bounds of STTR funds available to the Army at the time of award. If no proposals in a topic merit award relative to the proposals received in other topics, the Army will not award any contracts for that topic.

Proposals for Phase I are limited to a maximum of $100,00 over a period not to exceed six months.

Any Phase II contracts resulting from Phase I proposals submitted for this solicitation will be limited to a maximum of $500,00 over a period of two years. Phase II contracts will be structured as a single year contract with a one year option.

Department of the Army
Small Business Technology Transfer Program Solicitation
Topic Titles FY 1998

ARMY98-T001 Magnetic Resonance Force Microscopy

ARMY98-T002 Real-time, Two-Dimensional Terahertz Wave Imaging

ARMY98-T003 Catalysis of Technologically and Environmentally Significant Processes

ARMY98-T004 Distributed Interactive Agents

Department of the Army
FY 1998 STTR Topic Description

ARMY98-T001 TITLE: Magnetic Resonance Force Microscopy

KEY TECHNOLOGY AREA: Materials, Processes and Structures (DTA-15)

OBJECTIVE: Design, construct and operate a magnetic resonance force microscopy capable of in-situ detection of individual magnetic moments (single electron or nuclear spins), and three dimensional mapping of their position with subangstrom spatial resolution.

DESCRIPTION: Identify an integrated approach to the construction of a magnetic resonance force microscope, which will have sufficient sensitivity to detect a single electron spin. The emphasis is on exploring both hardware and software innovations that will significantly advance the technology with respect to the current state of the art. Proposals should include the construction and demonstration of a prototype system. Approaches that offer the prospect of eventually providing single nuclear spin detection will be given highest priority.

PHASE I: Investigate and demonstrate the feasibility of developing a magnetic resonance force microscopy with sufficient sensitivity to detect a single electron spin.

PHASE II: Implement the innovation, which shall include the design and testing of prototype systems. Extend the research to determine whether single nuclear spin detection is feasible. Explore major cost and reliability issues associated with the technology in the context of commercial viability.

PHASE III DUAL USE APPLICATIONS: Magnetic resonance force microscopy offers the capability of mapping the composition and crystal structure of a material at angstrom spatial resolutions. This capability has broad commercial and military utility including: advanced semiconductor device research (e.g. individual impurity and defect characterization), single molecule analytical chemistry, infectious disease research, and new solid state physics research (e.g. investigations of electron spin coupling mechanisms and quantum computational physics). This research is intended to introduce a new analytical instrument that affords single atom detection and resolution.

ARMY98-T002 TITLE: Real-time, Two-Dimensional Terahertz Wave Imaging

KEY TECHNOLOGY AREA: Sensors (DTA-16)

OBJECTIVE: Demonstrate a real-time, two-dimensional, terahertz wave imaging system with a resolution exceeding 100x100 pixels at video frame rates.

DESCRIPTION: The terahertz (THz) region of the electromagnetic spectrum, spanning the wavelength range from approximately 1 mm to 100 m, has been greatly underutilized because of the difficulty in generating and detecting THz radiation. Remarkable progress has been recently made in the use of electronic and optical rectification to generate broadband coherent sources of THz radiation and the use of free-space, electrooptic sampling techniques for sensitive detection of the radiation [1, 2]. These advances offer the potential for real-time, two-dimensional, terahertz wave imaging, which would provide numerous new capabilities. Examples of applications include detection of pollutants; quality control in food products; diagnosis of diseased tissue; security screening for plastic explosives; short-distance, covert imaging; and collision avoidance for aircraft and ground vehicles. To realize this promise, the radiators need to be optimized for efficiency, power, radiation pattern and bandwidth, the detectors need to be optimized for sensitivity, speed, and resolution, and the components need to be optimally integrated into an imaging system.

PHASE I: Proof-of-principle analysis, including theoretical modeling to select optimal components such as the THz emitter, the electrooptic crystal, the CCD, and optical design.

PHASE II: Demonstration of system components and implementation of a prototype that allows two-dimensional imaging of THz waves with a spatial resolution of better than 100x100 pixels at video frame rates. Identify and resolve any key problems that might otherwise impede successful commercialization.

PHASE III DUAL USE APPLICATIONS: Real-time, two-dimensional THz wave imaging has an enormous potential commercial market in medical applications, environmental monitoring and security screening for difficult to detect plastic explosives, in addition to other commercial possibilities. Military applications include short-range, covert collision avoidance systems for helicopters, detection of chemical and biological agents, and testing of chemical battlefield uniforms.

REFERENCES:

1. A. Nahata, A. S. Weling, and T. Heinz, "A Wideband Coherent Terahertz Spectroscopy System Using Optical Rectification and Electro-optic Sampling", Appl. Phys. Lett. **69**, 2321 (1996).
2. Z. G. Lu, P. Campbell and X.-C. Zhang, "Free-space Electro-optic Sampling with a High-Repetition-Rate Regenerative Amplified Laser", Appl. Phys. Lett. **71**, 593 (1997).
3. D.M. Mittleman, R. H. Jacobsen, and M. C. Nuss, "T-Ray Imaging", IEEE J. of Selected Topics in Quantum Electron. **2**, 679 (1996).

ARMY98-T003 TITLE: Catalysis of Technologically and Environmentally Significant Processes

KEY TECHNOLOGY AREA: Chemical and Biological Defense (DTA 5)

OBJECTIVE: To prepare and optimize Polyoxometalate (POM)-containing or POM-based polymeric materials amenable to textile manufacture and other applications and capable of catalytic decontamination of chemical warfare agents. Recent research in the laboratory of Craig Hill at Emory University has revealed that POMs have promising utility in catalysis of several hydrolytic and oxidative processses, including for example the replacement of chlorine bleach in wood-pulp bleaching processes. Research in the destruction of chemical warfare simulants has been especially promising and new efforts in the preparation of thread and network POM-containing materials suggests that this research is ripe for capture and transfer into technology development.

PHASE I: Identify military and civilian processes where POMs could have significant impact and conduct proof-of-principle experiments to show that use of POMs will show an improvement over current technologies.

PHASE II: Expand the Phase I efforts to demonstrate scale-up potential and resolve any key problems which could otherwise prevent successful commercialization. Tests with live chemical warfare agents are required in Phase II if decontamination processes are a goal of the Phase I effort.

PHASE III DUAL USE APPLICATIONS: Protective clothing for the Agrochemicals industry such as pesticide and herbicide workers; self-decontamination fabrics and self-bleaching textiles. Removal of noxious sulfide odors from wood-pulp bleaching operations and other industrial processes. Applications of POMs in photocatalytic processes, e.g. water purification, are also expected.

ARMY98-T004 TITLE: Distributed Interactive Agents

KEY TECHNOLOGY AREA: Modeling and Simulation (DTA-19)

OBJECTIVE: Develop and demonstrate approaches to incorporating cognitive, emotional, personality, and moral components of human performance in modern simulations and models.

DESCRIPTION: Human behavioral characteristics are critically important to determining the outcome of land combat but there are few ways of inserting them into modern simulations and models. In particular, current army doctrine depends upon cognitive, motivational, and moral variables such as leadership, level of training, unit morale and cohesion. Distributed interactive simulations using the High Level Architecture (HLA) and virtual training technologies have matured steadily for use in training diverse skills at dispersed or remote locations, or for

refreshing previously learned skills or knowledge. Yet, these technologies still do not include the impact of human behavior in warfighting analyses or simulations. Current models of constructive simulations use attrition-based algorithms and do not include important variables such as information flow management, fear, training proficiency, artillery suppression, and fatigue. These are difficult issues to capture in computational models and require new avenues of research in this fundamentally important area for the Army, to correlate and leverage diverse efforts. Significant progress might be possible if research efforts took advantage of the advances in modeling human agents and human performance in distributed communications of intelligent agents within financial, economic, industrial, and entertainment industries; using architectures arising from artificial intelligence and virtual reality research, such as production rules, neural networks, and semantic network systems. The potential gain from even small improvements in our understanding and ability to model human behavioral factors would be significant.

PHASE I: Demonstrate proof-of-principle of these approaches to modeling the human cognitive, emotional, personality, and moral components of human performance.

PHASE II: Application of the developed simulation and modeling technologies to an important training requirement.

PHASE III DUAL USE APPLICATIONS: Civilian applications could include industrial training, financial management, and entertainment businesses in addition to the large number of potential applications in the military combat modeling market.

NAVY STTR
PROPOSAL SUBMISSION

INTRODUCTION:

The responsibility for the implementation, administration and management of the Navy SBIR program is with the Office of Naval Research (ONR). The Navy SBIR Program Manager is Mr. John Williams ((703) 696-0342). All SBIR Phase I and Phase II proposals as well as Phase III progress should be forwarded to Mr. Williams at the address below. If you have any questions, problems following the submission directions, or inquiries of a general nature, contact me. All Phase I proposals are due by 2:00 p.m. EST on **15 April 1998** and must be submitted to:

Office of Naval Research
ATTN: Mr. John Williams; ONR 362 SBIR
800 North Quincy Street
Arlington, VA 22217-5660
(703) 696-8528

NEW THIS YEAR:

1. The Navy is now requiring that all Phase I proposals have an electronically submitted Appendix A, B & E.
2. All Phase I award winners must electronically submit a Phase I Summary Report to the Navy at the end of the Phase I effort. This requirement will also be included in Phase II contracts and is described in further detail below.
3. The Navy requires that all Phase II proposals include an electronically submitted Appendices A, B and E.
4. The Navys Phase I base effort should run for 6 months (not 12 months as explained in the DOD section) and the Phase I option should run for 3 months.

PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria must be met or your proposal will be REJECTED.

1. **You must use the electronic format described in the section "Electronic Submission" described below. The Navy will not accept any proposals that are not submitted in electronic format for Appendices A, B, and E.**

2. **Your Phase I proposed cost for the base effort can not exceed $70,000 and should not exceed 6 months. Your Phase I Option proposed cost can not exceed $30,000 and should not exceed 3 months. The costs for the base and option should be clearly separate and identified on Appendix A, the cost proposal and in the work plan section of the proposal.**

3. **Your proposal must be received on or before the deadline date. The Navy will not accept late proposals, if you have any questions or problems with submission of your proposal allow yourself time to contact the Navy and get an answer to your question. Do not wait until the last minute.**

ELECTRONIC SUBMISSION OF APPENDICES:

There are two ways to submit your SBIR proposal to the Navy, the preferred method is the online submission. **The Navy <u>WILL NOT</u> accept the Red Forms in the rear of this book as valid proposal submission forms of the**

Appendix A, B and E or the Electronic download forms from any DOD Homepage. Instead proposers must use **one** of the following procedures **(but not both)**. The preferred and easier method is the Online Submission.

1. Online Submission (through the Navy SBIR/STTR Bulletin Board)

A. Go to SBIR/STTR Bulletin Board (http://www.onr.navy.mil/sci_tech/industrial/sbir_bbs), click on "Online/Electronic Data Entry Forms (SBIR/STTR)" then click on "Online Proposal Submission Interface".
B. Submit your Appendix A, B and E via the Online Submission option. Just fill out all the information requested, the screen format will look different then the forms in the solicitation. Once, you have filled in the data, follow the instructions to electronically submit appendices. That is, make sure you click on the Submit button.
C. After you have received acknowledgment of receipt, print out and sign the Appendix A/B and E form.
D. Submit the signed Appendix A/B and E form along with one original and four copies of your entire proposal (each copy should include a copy of the signed Appendix A, B and E forms) to the Navy STTR Program Office at the above address. Mark the outside of the envelope with your topic number.

2. Diskette submission

A. Obtain the Navy STTR Appendix A, B and E program from the Navy SBIR/STTR Bulletin Board (http://www.onr.navy.mil/sci_tech/industrial/sbir_bbs)
B. Select "Online/Electronic Data Entry Forms (SBIR/STTR)" and follow the instructions for Diskette Submission. For Mac users go to the forms for Macs.
C. **Don't select the highlighted sbir_ab.exe file, go down to the files specifically for STTR's.**
D. Data enter information.
E. Save file with .dat extension.(Do not save in a word processing format)
F. Print out and sign the Appendix A, B, and E form.
G. Submit the signed Appendix A, B and E form along with one original and four copies of your entire proposal (including 4 copies of the signed Appendix A, B & E form) together with a disk containing the .dat file generated from the Appendix A, B and E program to the Navy SBIR Program Office at the above address. (Please note we do not want the entire proposal text on disk, just the Appendix A, B and E.) Mark the outside of the envelope with your topic number.

NEW AT COMPLETION OF PHASE I AND PHASE II
ELECTRONIC SUBMISSION OF PROJECT REPORTS:

The submission of an Electronic Phase I Summary Report will now be required at the end of Phase I and a Phase II summary report at the end of the first and second year of a Phase II effort. The Phase I Summary Report is a summary of Phase I results, includes potential applications and benefits, and should not exceed 750 words. It should require minimal work from the contractor because most of this information is required in the final report. The summary of the final report will be submitted through the Navy SBIR/STTR Bulletin Board at: "http://www.onr.navy.mil/sci_tech/industrial/sbir_bbs/" much like the Online submission of Appendices. If your company does not have access to the Internet consult your local library or local computer service store.

The Navy is initiating this new program to help increase the awareness and implementation of STTR funded efforts. The goal is to increase the market potential and transition of STTR projects by increasing the visibility and ease in accessing information about STTR projects to DOD, government and DOD industry contacts. This should facilitate the transition of these projects into follow-on efforts and bring additional revenue to the STTR Company.

To do this the Navy is requiring companies to provide information on the status and benefits of their technology developments so that this information can be put into a media that others can easily access and review (Like the Navy SBIR/STTR Database). The Navy plans to redistribute this information to a wide audience using such tools as the Navy Webpage, Accomplishment Book and a new interactive Navy STTR Website. This will help proved parties with technical challenges or those with the need to implement new technology, with a user-friendly mechanism to access and identify STTR companies that can provide them with solutions. This information should

be **non-proprietary** yet detailed enough to provide the interested transition partner with enough knowledge to understand the potential use and benefit to their program.

YOUR SUBMISSION TO THE NAVY STTR PROGRAM:

This solicitation contains a mix of topics. When preparing your proposal keep in mind that Phase I should address the feasibility of the solution to the topic. Be sure that you clearly identify the topic your proposal is addressing. Phase II is the demonstration of the technology that was found feasible in Phase I. Only those Phase I awardees which have been invited to submit a Phase II proposal by the Navy technical point of contact (TPOC) during or at the end of a successful Phase I effort will be eligible to participate for a Phase II award (with the exception of Fast Track Phase II proposals – see section 4.5). If you have been invited to submit a Phase II proposal to the Navy by the TPOC, obtain a copy of the Phase II instructions from the Navy SBIR/STTR Bulletin Board on the Internet or request the instructions from the Navy STTR Program Office. All Phase I and Phase II proposals should be sent to the Navy STTR Program Office (at the above address) for proper processing. Phase III efforts should also be reported to the SBIR program office noted above.

The Navy will provide potential awardees the opportunity to reduce the gap between Phases I and II if they provide a $70,000 maximum feasibility Phase I proposal and a fully costed, well defined ($30,000 maximum) Phase I Option to the Phase I. **The Navy will not accept Phase I proposals in excess of $70,000 (exclusive of the Phase I option).** The technical period of performance for the Phase I should be 6 months and for the Phase I option should be 3 months. The Phase I Option should be the initiation of the next phase of the STTR project (i.e. initial part of Phase II). When you submit a Phase II proposal it should consist of three elements: 1) a $400,000 maximum demonstration phase of the STTR project (i.e. Phase II); 2) a transition or marketing plan (formally called a "commercialization plan") describing how, to whom and at what stage you will market your technology to the government and private sector; 3) a Phase II Option ($100,000 maximum) which would be a fully costed and well defined section describing a test and evaluation plan for further R&D if the transition plan is evaluated as being successful. You must also submit your Phase II appendix A,B&E electronically to the Navy STTR Program Office at the address above. While Phase I proposals with the option will adhere to the 25 page limit (section 3.3), Phase II proposals together with the Phase II Option will be limited to 40 pages (unless otherwise directed by the TPOC or contract). The transition plan should be in a separate document.

The Navy will evaluate and select Phase I proposals using scientific review criteria based upon technical merit and other criteria as discussed in this solicitation document. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.

The names of firms whose proposals have been selected for further consideration will be posted by topic number on the **Navy SBIR/STTR Bulletin Board**, under the STTR Program Information within 3 months of the proposal deadline. In addition the abstracts of companies that have received Phase I awards will be posted on the bulletin board within 5 months of proposal deadline.

Phase I awardees should submit a 5-page preliminary plan for Phase II to the Navy STTR Program Manager at the address above, 5 months and 2 weeks after contract award. However, only those Phase I awardees which have been invited to submit a formal Phase II proposal by the TPOC will be eligible for a Phase II award (with the exception of Fast Track Phase II proposals – see section 4.5). If you have been invited to submit a Phase II proposal to the Navy TPOC, get a copy of the Phase II proposal preparation and submittal guidelines from the Navy SBIR/STTR Bulletin Board.

NAVY FASTTRACK DATES AND REQUIREMENTS:

All Fast Track Applications and required information must be sent to the Navy STTR Program Manager at the address listed above and to the Contracting Officers Technical Monitor (the Technical Point of Contact (TPOC) for the contract). The following dates and information are required by the company to qualify for the FastTrack program. All of the requirements listed in the FastTrack Section of the front of this solicitation must be met. The

information provided below provides specific dates and some additional information that is required by the Navy STTR Program Office.

Party/Days After Phase I Award	**Required Deliverables**
STTR Company / 150 Days	- Fast Track Application and all supporting information. (See instructions in the DOD section of this Solicitation) - Phase II 5 Page Summary Proposal as is required of all Phase I projects described in Navy STTR Website, listed above) - It is strongly recommended that if you are contemplating the submittal of a Fast Track Application, you make your intention known to your technical point of contact (TPOC) and the STTR Program Manager - Request to initiate Phase I option (interim funding) which must have been included in original Phase I proposal.
STTR Company /181 - 200 Days	- Phase II Proposal - Phase I Final Report
Navy / 181 - 200 Days	- Navy will initiate option funding if all requirements are met.
Navy/ 201 - -205 Days	- Navy will formally Accept or Reject your Phase II proposal.
STTR Company /45 Days after Acceptance	- Proof that Funding has been received by STTR company.

NAVY STTR FY 1998 TOPICS

N98-T001 TITLE: Multiscale and Multiresolution Image Enhancement and Classification System For Precision Strike

OBJECTIVE: Produce an integrated collection of computational tools, for PC's, which combine multiscale partial differential equations (PDE) and wavelet (multiresolution) image enhancement techniques with one or more methodologies for object (target) characterization. Demonstrate, on exogenous data, the effectiveness of enhancement for characterization/classification.

DESCRIPTION: Wavelets are a fairly well established technology for image processing and some good software is available [Ref. 1,2]. Successful applications include wavelet denoising, the use of wavelets to characterize texture and to search on this description, and image compression. Multiscale (PDE) methods [Ref. 3,4] are newer (late 80's to early 90's) and although little commercial software is yet available, many important applications have been demonstrated by universities. These include denoising/ deblurring, segmentation, optimal contrast enhancement, the use of color, and several others. A great deal of multiscale software is available from universities or could be easily constructed from published algorithms. The wavelet dictionary approach [Ref. 5] to object characterization, combined with sophisticated statistical pattern recognition [Ref. 6] shows great promise for classification/identification, but has not yet been applied to images.

The Navy is making increasing use of imaging sensors--SAR, ISAR, EO, IR, Optical for surveillance, precision strike, automatic target recognition, etc. All images contain a great deal of information which the unaided human viewer cannot see. The methods proposed here will make much of that information available and will aid target classification.

The aim here is to implement a selected subset of multiscale and multiresolution methods into a commercial quality software package with interfaces so that users can integrate other software. The criterion for selection of the methods to be implemented is to be their potential usefulness for enhancing not only images but classification on these images. This will, of course, depend on the classification method chosen for integrated implementation. The straw-man classification method is the use of wavelet dictionaries combined with statistical pattern recognition. Other methods may be proposed, but must be compared to and shown in some ways more promising than the straw-man. The contractor will demonstrate the system on a classification problem using data chosen by ONR and not used in the development of the classifier.

The product developed here is an advanced research and development software design tool in which image enhancement methods can be compared and evaluated in many ways, particularly with regard to their effect on classification.

PHASE I: Software candidates will be tested and "winners" chosen. Initial study of compatibility of enhancements methods with chosen classification methodology.

PHASE II: Integrated software system including multiscale and multiresolution methods and a classifier will be constructed and tested. Demonstration of classification will be carried out.

PHASE III: Develop and carry out commercialization plan for the software and the Navy will transition and implement this software into existing and future automatic target recognition and classification systems.

COMMERCIAL APPLICATIONS: The technology developed will have direct application in commercial space observation systems, in security/surveillance systems, and in forensics sciences.

REFERENCES:

[1] E. Hernandez and G. Weiss, "A First Course on Wavelets", CRC Press, 1996.
[2] A. Bruce and H-Y Gao, "Applied Wavelet Analysis with S-Plus", Springer, 1996.
[3] L. Rudin and S. Bramble, Editors, "Investigative and Trial Image Processing", SPIE Volume 2567, July, 1995.
[4] J.A. Sethian, "Level Set Methods", Cambridge University Press, 1996.
[5] N. Saito and R. Coifman, "Improved Local Discriminant Bases Using Empirical Probability Estimation", American Statistical Assn. Proceedings on Statistical Computing, 1996.

[6] Q. Huynh, L. Cooper, N. Intrator, and H. Shouval, "Classification of Underwater Mammals Using Feature Extraction Based on Time-Frequency Analysis and BCM Theory, IEEE-SP, Special Issue on Neural Net Applications, Nov. 1997.

N98-T002 TITLE: Hypersonic Weapon Sensors & Windows

OBJECTIVE: Develop highly accurate search sensors and windows with capabilities to perform in plasma flow fields at velocities of Mach 7.0

DESCRIPTION: At velocities approaching Mach 7, traditional search sensors (LWIR, RF, Optical, and Electronic) become limited in usefulness or ability to discriminate objects in or under the vehicle's flight path due to high energy states in the surrounding plasma flow field, or due to the need to heavily protect sensors from intense heat produced by aerofriction and heat radiation caused by the surrounding plasma. Development of a new type of sensor, sensor window, and set of robust filter algorithms which reduce plasma effects or operate regardless of the hypervelocity induced plasma environment surrounding a flight vehicle, and have a long sensing range (>10km) and image resolution suitable to perform sensing/search operations in time critical environments (<0.1 sec refresh rates) are necessary to overcome this limitation. Studies examining Sapphire (Aluminum Nitride) for midwave infrared seeker windows on high speed missiles have been shown to have strong thermal shock resistance, but at the cost of birefringence. Birefringence causes significant optical scatter and reduces the ability to produce an acceptable transparent polycrystalline seeker window. Materials with high thermal shock resistance, such as Sapphire, are also needed for the acceleration phase of an ascending hypersonic vehicle. The goal of this effort is to examine the effects of hypersonic flight on sensor and seeker window requirements. For Sapphire window and midwave IR seekers this could include the fabrication of a midwave IR (3-5 micron wavelength) window (aluminum nitride or other suitable window material) with a scatter of less than 2%, and an absorption coefficient less than 0.1 per centimeter, and thermal conductivity of 160 watts per meter Kelvin (at 20°C), with a matched midwave IR search sensor. The effort would also study the effects of Mach 7 aeroheating and neighboring plasma fields on sensors performance in both flat and dome windows in both high and low altitude flight.

PHASE I: Identify window and sensor technologies to be developed and detail where and why they will be effective for hypersonic IR seeker applications. Identify sensor filtering algorithm requirements for onboard image processing systems. Determine ability to fabricate a seeker window by producing laboratory test samples and conducting suitable testing for transmittance and birefringence to show future ability to meet goals stated. Correlate sensor and window properties to projected hypersonic plasma fields, thermal shock loading, and aeroloading on typical flight vehicle structures.

PHASE II: Demonstrate the feasibility of fabricating sensor windows of a size well matched to suitably test and prove manufacturability by producing bench level test units. Address expected mechanical strengths and ability to survive thermal shock and temperature dwells from 20-1000°C. Develop plans for processing hardware specifications, software toolkits, and sensor specifications (as required) to provide ability to search both in high altitudes (+17Km) and low altitudes (on near vertical decent). Provide test data from benchtop test and demonstrations to provide extrapolation for search performance characteristics in a plasma field. Develop commercialization (phase III) plan. Establish criteria for database of physical and optical qualities of seeker and window materials considered and investigated, including thermal conductivity, mechanical strength, modulus, expansion coefficient and optical absorption coefficient and populate with known or test data. Determine need for anti-reflection coatings and ability to survive long term sea state (Salt Fog/Sand Erosion) environment.

PHASE III: Implement phase III fabrication plan developed in Phase II.

COMMERCIAL POTENTIAL: This technology can be used for sensors and windows used in the process monitoring of high temperature processes including high thermal shock loading. The sensors and windows can also be used in commercial high high speed research, and spacelift platforms which require the ability to sense and detect inflight obstacles or are used for high speed environmental data gathering.

REFERENCES: D.C. Harris, :Infrared Window and Dome Materials," (ISBN 0-8194-0998-7) SPIE Press, Volume TT10, 1992

N98-T003 TITLE: Adaptable Sensor Processing and Data Fusion for Passive Target Identification and Recognition for Autonomous Systems

OBJECTIVE: Develop a reconfigurable, modular, adaptable signal processor to support multiple sensors and multiple platforms and develop imaging, fusion, and ATR methods for autonomous systems using passive sensors

DESCRIPTION: It is desired to develop a multipurpose signal processor and data fusion techniques for use in UAVs, weapon systems, and information-gathering systems to aid automated passive surveillance, target detection, classification, and identification, and scene generation. The goal is to develop multipurpose signal processor architecture to supports both multiple use and dynamic reconfiguration and to effectively fuse passive sensory data to form the tactical scene with sufficient resolution, to operate on available multisensor fused-database, to identify single objects (mobile or fixed), and to estimate target class, membership within a class, etc. in real-time. That is, the signal processor should be able to support systems equipped with different sensors as well as switching dynamically between different sensors during a mission. It should also be extensible, to support both low-cost single-sensor systems (by using one processor unit) or multi-sensor, high performance surveillance systems (by using multiple processor units).

The sensors that the processor should be able to support include staring infrared, conventional and low-light visible imagery, radar, millimeter-wave radiometry, electronic intelligence and anti-radiation homing receivers, Global Positioning System signal (including anti-jam processing and location of jammers) and support for data link transmission and reception. Sensor functions to be supported include feature extraction, automatic target recognition and region of interest identification, wavelet transforms, data compression, synthetic aperture. The processor should be dynamically reconfigurable such that it can support time-slicing of multiple operations, as well as changing modes stepwise through the mission or reconfiguration for different missions. Very high component density is needed for the small platforms, also desired are low-voltage and low-power circuitry, and dense packing assembly methods are important.

Passive all weather scene generation is a significant technical challenge, and high speed information signal processing , filtering and precise algorithms do not exist. Techniques used today for identification proposes range from well-known, statistical based algorithms such as classical inference and Bayesian methods to ad-hoc techniques such as template matching and adaptive neural networks. Passive surveillance techniques based on passive sensory information using integrated sensors such as Low-Light-Level-Charged-Coupled-Devices, IR, and Passive-millimeter-wave imaging devices are desired. The desired automated passive surveillance systems for autonomous systems are:

1. Registration and fusion of passive sensors (this issue is compounded by the fact that these sensors have different resolution and orientations);
2 Automatic target detection, cueing, and identification based on passive sensors;
3. Recognition algorithms based on;
4. Parametric classification using both the statistical (Bayesian, etc.) and information theoretic techniques (cluster algorithms, adaptive neural nets, etc.) pattern recognition and neural networks;
5. Cognitive-based models (Fuzzy Set Theory and Knowledge-based Systems);
6. Physical modeling (syntactic, estimation, or simulation)

The expected surveillance imagery and target information will be an accurate and concise estimate of the scene, target location and motion, target classification and attributes, and pertinent features.

PHASE I: Assess the functions and throughput required for the different signal processing tasks. Develop a set of hardware blocks that can be configured into an architecture to provide the needed functionality. Demonstrate key elements of the functionality in a simulation. Determine the approach for the fusion of advanced visible, infrared, and passive millimeter-wave imaging devices. Determine the scientific, technical merit, and feasibility of the application of the methods for Passive Automatic Target Identification and Recognition based on passive sensors on board a UAV. Quantify ATR performance

PHASE II: Demonstrate the complete architecture in a simulation. Fabricate prototype hardware and verify its performance, dynamic reconfigurability, and adaptability. Demonstrate the selected approaches and image fusion algorithms in real-time using multipurpose signal processor environment in an autonomous fashion.

PHASE III: Produce signal processors for use in new weapon systems. Potential applications include targeting sensors and a terminal seeker for Guided Munition. Develop and carry out commercialization and transition plan

COMMERCIAL POTENTIAL: Adaptable Sensor Signal Processors and Passive Target Identification and Recognition have direct applications to video image processing, image compression, multi-spectral imagery for land-use planning, forestry, and agriculture, high-performance data communications, image recognition in factory, security., and intelligent highway systems.

REFERENCES:
K. Fukunaga, "Statistical Pattern Recognition", Academic Press Inc., 1991, New York NY., Proc IEEE, January 1997, "Special Issue on Data Fusion"

N98-T004 TITLE: Laser Initiation Of Explosives

OBJECTIVE: Development of a analytical method for determining initiation and transition to detonation of typical secondary bulk HMX, TNT and RDX wax based and plastic bonded explosives (such as Octol, PBXN-110 or Comp-C4) with or without a thin cover of aluminum or steel, due to localized laser excitation. The method used must be translatable to developments using standard explosive modeling to examine localized effects of heating, excitation and component material degradation.

DESCRIPTION: There is a need to improve the ability to model high energy laser technology and plastic bonded high explosive interaction for laser based ship defense, explosive operations safety, and demilitarization operations. Laser initiation of explosive molecules and individual constituent components (such as plasticizers and binders) have been investigated previously, however the examination of laser induced thermal decomposition and simultaneous shock initiation of commonly used plastics explosives with HMX, RDX and TNT bases with and without covers of aluminum or steel have not been thoroughly investigated. Initiation theories of damaged materials and their interactions with thermal shocks, physical shocks or high energy plasma states produced by the laser, or on a covering metal plate, are not well developed for un-dope-ed explosives, such as Octol or Composition C-4. Statistical as well as probabilistic approaches may be required to determine reaction severity, such as deflagration and detonation. Basic theoretical developments are required to improve predictive and analytical capabilities for laser induced detonation of common un-doped explosives, inside and outside metallic containers or warheads.

PHASE I: Development of theoretical techniques and analytical or statistical models for implementation of Laser initiation of common plastic bonded and common wax based cast explosives (such as Octol). Determine ability and energy requirements for common or commercially available laser systems, such as FEL and Q-switched lasers to successfully detonate undoped explosives. Development of small scale laboratory experiments suitable for examining explosive reactions and influence of both laser strength and duration. Determine atmospheric and weather impact on various laser systems output and determine output energy and time on target requirements for distances from 5 meters to 20 kilometers.

PHASE II: Conduct small scale, and if needed, large scale explosive testing to validate, populate, or construct numerical, statistical, and/or probabilistic models for laser initiation of common explosives with and without metallic casing materials. Develop a demonstration system capable of detonating visible, but small anti-personnel mine systems or submunitions, such as unfuzed M42 or XM-80 antipersonnel grenades. Develop fabrication and system requirements for both small and large scale laser systems capable of detonating cased and uncased explosive materials in the field or for shipboard use. Develop commercial technology transfer and commercialization plans, including descriptions of additional and specific tests, evaluations, and implementations to be performed.

PHASE III: Develop a road map for making these capabilities operational and ready for transition. Demonstrate predicted performance in operational or industrial setting. Upon testing and evaluation, the system will be commercialized.

COMMERCIAL POTENTIAL: The technology developed here can be used to increase the safety and sequential accuracy of multiple charge detonation used in mining and building demolition applications, and eliminate the need to transport larger demolition explosives over rail and road. The technology can also be applied for humanitarian operations such as demolition of dud munitions in the field.

N98-T005 TITLE: Learning and Adaptation for High-level Intelligent Control in Rapidly Varying Environments

OBJECTIVE: To investigate the methodology of Multiple Models, Switching and Tuning for Nonlinear Systems, and its applications to flight control of Air Vehicles.

DESCRIPTION: Control system design has traditionally been based on a model of the system to be controlled. The best developed part of control theory deals with the control of linear time-invariant systems. If the system is assumed to be linear and time-invariant and is described by equations that are known, powerful methods exist for its control. Adaptive control that was developed in the 1970s and 1980s deals with the control of linear systems whose parameters are either constant or vary slowly with time. However, as systems become more complex, a new class of problems is being encountered for which general methods of control have to be developed. This class of problems is characterized by rapidly changing environments, failures in sensors and actuators, navigation with new structural information, control in the presence of changing performance criteria or reference trajectories are typical examples of such problems. The task of the control system in the above cases is to recognize the situation that exists and provide the appropriate control input in a relatively short time. Conventional robust and adaptive control methods are not adequate to achieve this objective, and more sophisticated methods are needed.

A new methodology has been developed recently based on multiple models, switching and tuning [Ref. 1]. The basic idea of the approach is to store models of the different environments in which the plant may be expected to act, determine which environments currently exists, and use the appropriate controller. Extensive theoretical analysis, stability proofs, and computer simulations have been carried out. On the basis of the work done thus far it has become clear that the general approach has enormous potential both as a source of interesting theoretical problems and as a methodology of great practical relevance.

The overall objective of the project is to investigate the methodology of multiple models, switching and tuning in the context of nonlinear models of air vehicle dynamics. Using artificial neural networks, numerous complex nonlinear systems can be controlled [Ref. 2]. Some of the questions to be addressed are as follows:

1. How are different models of the system to be created? Is the generation of the models specific, or can general procedures be developed? What are the conditions that the system must satisfy if models are to be generated successfully?

2. Should the models be fixed or adaptive or should a combination of the two be used?

3. If new models are to be created, should old models be discarded? If so, on what basis should this be carried out?

3. What is the criterion that determines the choice of a controller at any instant?

4. Is learning to be an ongoing process or to be initiated at the discretion of the designer?

5. What is the criterion used for the creation of a new model?

The above questions relate to the application of the new methodology to model reference control. The scope of the problem should also be extended to include general optimal control problems. To obtain on-line solutions to such problems, substantial amounts of information must be gathered off-line and stored in neural networks.

Air vehicles, due to their complexity and high nonlinearity provide an ideal benchmark for the methodology. The project will investigate the applicability of Multiple Models, Switching and Tuning for the control of such vehicles in nonlinear uncertain regimes such as high angles-of-attack.

PHASE I: Investigate the problems associated with the utilization of the methodology of "Multiple Models, Switching and Tuning" for nonlinear systems using neural networks. Investigate the applicability of these methods for the control of air vehicles operating in nonlinear and time varying flying regimes, and subjected to failures and inherent uncertainties.

PHASE II: Develop a prototype of a "Neurocontroller" for a specific air vehicle, capable of performing autonomously during the course of an entire flight procedure. Demonstrate its performance characteristics. Develop a commercialization plan, including descriptions of specific tests, evaluations and implementations to be performed.

PHASE III: Carry out the commercialization plan developed in Phase II.

COMMERCIAL POTENTIAL: The resulting system will have broad applications in power industry, manufacturing, commercial aviation systems, and other areas.

REFERENCES:

[1] K. S. Narendra and J. Balakrishnan, "Adaptive Control using Multiple Models", IEEE Transactions on Automatic Control, Vol. 42, No. 2, pp. 171-187, February 1997.

[2] K. S. Narendra and Sai-Ming Li, "Neural Networks in Control Systems", a chapter in "Mathematical Perspectives on Neural Networks", P. Smolensky, M.C. Mozer, and D.E. Rumelhart.

N98-T006 TITLE: Intelligent Supervisory Control Architecture for Health Monitoring, Fault-detection, Sensor Management, and Reinforcement Learning System for Adaptive Air Vehicles

OBJECTIVE: Develop flexible architectures, software tools, and systematic procedures for the design of intelligent adaptive air vehicles capable of:

1. Real-time supervisory systems control;
2. Health monitoring and fault detection for vehicles operating in multiple regimes Real-time dynamic performance and model validation;
3. Real-time reconfiguration and resource management should an unanticipated event occur;
4. Real-time reinforcement learning for adaptive control and allocation of sensors.

DESCRIPTION: Future air vehicles will be expected to operate in a wide range of flight regimes, under stringent flight commands and mission constraints, and in the presence of large uncertainties and subsystem failures. Hence, there is a need for developing a truly intelligent supervisory systems control architecture capable of achieving the desired performances autonomously while operating in a time-varying environments, in the presence of large external and/or internal perturbations, and systems failures.

The proposed effort should focus in part on the development of intelligent adaptive control in the presence of parametric uncertainty for the identification and control of unknown nonlinear systems. [1-5].

Verifying performance and safety under all possible operating conditions for complex systems such as UAVs are very difficult because of unanticipated faults, or operational circumstances, or design omissions. It is critical to have an autonomous monitoring system that is capable of real-time diagnostics, fault detection, and resource management. The proposed effort should develop a real-time monitoring system and supervisor that would have real-time capabilities such as: fault detection and model validation; performance prediction; reconfiguration and resource management, and feedback design. It should have a hierarchical structure with continuous as well as discrete controllers. The lower layer of the supervisor would continuously collect the data from various subsystems and perform the task of model validation and fault detection. The higher level of the supervisor would be involved in making decisions regarding reconfiguration, development of new control strategies/laws, and resource management.

A health monitor/fault detector (HM/FD) for a system compares the states of the system with certain bounds known to be satisfied by a "healthy" system, and flags an alarm if these bounds are violated. More sophisticated algorithms are capable of classifying faults. One key assumption followed in the design of current HM/FD algorithms is the existence of one unique "healthy" operating regime, against which the running system is compared. Many practical systems however operate in different regimes. "Regime" means a region of state space, defined by bounds on certain state variables of interest, such as angle of attack, or speed. Dynamics of a system can change from one regime to the other, so if a system with an HM/FD algorithm designed to operate on just one regime, will flag as a fault when it switches to a different regime. The proposed effort should investigate HM/FD algorithms capable of operating on different regimes utilizing gated networks. The goal is to design HM/FD algorithms which work well on a certain regime. These local algorithms are labeled gated experts, and "adapt" their width to match the noise level in that regime.

Reinforcement Learning (RL) methods are novel combinations of dynamic programming (DP) methods, stochastic approximation methods, and learning methods [6-9]. Learning classifier systems (LCS) are ruled-based machine learning systems that use genetic algorithms (GAs) as their primary rule discovery mechanism. LCS methods allow global optimization and can be used to solve DP problems.

Sensor management involves the selection and adaptive allocation of sensors, sensor modes, and sensor parameters to maximize their collective effectiveness for mission requirements. Sensor management systems for tactical air vehicles have been constructed using a variety of ad hoc methods. Most often these systems employ rule-based approaches and rely on the operator to make many real-time deployment decisions. The proposed effort should formulate the problem of sensor resource control and allocation within a mathematical programming framework and use RL to develop an optimal sensor management system.

PHASE I: Conduct a feasibility study of the suggested intelligent supervisory systems control architecture, the development of a real-time monitor and supervisor capable of real-time fault detection, performance prediction, model validation, real-time reconfiguration, feedback design, resource management should an unanticipated event occur, and gated networks combined with gated experts for designing HM/FD algorithms for systems operating in multiple environments. Test the suggested concepts using several benchmark examples.

PHASE II: Develop a prototype of the intelligent architecture and autonomous HM/FD system capable of operating well during the entire course of a flying procedure; test the concepts on a practical system; demonstrate performance characteristics; utilize reinforcement learning systems to optimally manage and allocate sensor resources; demonstrate use of optimization algorithms for adaptive flight control; develop a commercialization/transition Phase III plan, including descriptions of specific tests, evaluations, and implementations to be performed.

PHASE III: Develop a road map for making these capabilities operational and ready for transition. Demonstrate real-time performance. Upon testing and evaluation, the system will be commercialized.

COMMERCIAL APPLICATIONS: The resulting system will have broad applications in power industry, manufacturing, commercial aviation systems, and other areas.

REFERENCES:

[1] K. S. Narendra and K. Parthasarathy, "Identification and Control of Dynamical Systems Using Neural Networks", IEEE Transactions on Neural Networks, Vol. 1, pp. 4-27, 1990.

[2] J. D. Boskovic, "A Multiple Model-Based Controller for Nonlinearly-Parametrized Plants", Proc. 1997 Automatic Control Conference, Albuquerque, New Mexico, June 1997.

[3] K. S. Narendra, R. Shorten, and J. D. Boskovic, "Intelligent Control Using Multiple Models", Proc. the Ninth Yale Workshop on Adaptive and Learning Systems, New Haven, July 1996.

[4] K. S. Narendra and J. Balakrishnan, "Adaptive Control using Multiple Models", IEEE Transactions on Automatic Control, Vol. 42, No. 2, pp. 171-187, Feb 1997.

[5] C. Garcia, D. Prett, and M. Morari, "Model Predictive Control: Theory and Practice - A Survey", Automatica, Vol. 25, No. 3, pp. 335-348, 1989.

[6] R. S. Sutton and A. Barto, "Reinforcement Learning: An Introduction", MIT Press 1998.

[7] L.P. Kaebling, M. L. Littman, and A. W. Moore, "Reinforcement Learning: A Survey", Journal of Artificial Intelligence Research, Volume 4, 1996, pp. 237-284.

[8] S.W. Wilson,"ZCS: A zeroth level classifier system "Evolutionary Computation, 2(1), 1994, pp. 1-18.

[9] S.W. Wilson, "Classifier fitness based on accuracy", Evolutionary Computation, 3(1), 1995, pp. 149-176

AIR FORCE
PROPOSAL PREPARATION INSTRUCTIONS

The responsibility for the implementation and management of the Air Force STTR Program is with the Air Force Materiel Command, Wright-Patterson Air Force Base, Ohio. The Air Force STTR Program Executive is R. Jill Dickman, (800)222-0336. **DO NOT** submit STTR proposals to the AF STTR Program Executive under any circumstances. Addresses for proposal submission and numbers for administrative and contracting questions are listed on the following page

Technical questions may be requested using the DTIC SBIR Interactive Technical Information System (SITIS). For a full description of this system and other technical information assistance available from DTIC, please refer to section 1.5.c of this solicitation.

Pre-Solicitation Announcements (PSA), listing the full descriptions of the topics and the author of each, were issued by the individual AF laboratories in electronic and hard copies, after being announced in the Commerce Business Daily. Contact the laboratories directly for information on future PSAs (see activity/mailing addresses and phone numbers on the next page). Open discussions were held with the topic authors concerning technical aspects of the topics until this solicitation was released. Small businesses that did not know about the PSAs or did not participate in the exchange may find relevant questions or comments from these talks listed in SITIS.

For each Phase I proposal, send one original and three (3) copies to the office designated on the following page. Be advised that any overnight delivery may not reach the appropriate desk within one day.

Unless otherwise stated in the topic, Phase I will show the concept feasibility and Phase II will produce a prototype or at least show a proof-of-principle.

Air Force Fast Track

Detailed instructions on the Air Force Fast Track and Phase II proposals, consistent with this solicitation (section 4.5), will be given out by the awarding Air Force directorate along with the Phase I contracts.

PROPOSAL SUBMISSION INSTRUCTIONS

TOPIC NUMBER	ACTIVITY/MAILING ADDRESS (Name and number for mailing proposals and for administrative questions)	CONTRACTING AUTHORITY (For contract questions only)
AF98T001	CANCELLED	
AF98T002 thru AF98T010	Air Force Office of Scientific Research AFOSR/NI (Chris Hughes) 110 Duncan Avenue, Room 5115 Bolling AFB DC 20332-8050 (Chris Hughes, (202) 767-6962)	Ernest Zinser (202) 767-4992
AF98T011 thru AF98T013	Avionics Directorate WL/AAOP (Marleen Fannin) 2241 Avionics Circle, Bldg 620 Wright-Patterson AFB OH 45433-7318 (Marleen Fannin, (937) 255-5285, x4117)	Terry Rogers (937) 255-5830 Bruce Miller (937) 255-7143
AF98T014 thru AF98T017	Materials Directorate WL/MLIP (Sharon Starr) 2977 P Street, Suite 13, Bldg 653 Wright-Patterson AFB OH 45433-7746 (Sharon Starr, (937) 255-7175	Terry Rogers (937) 255-5830 Bruce Miller (937) 255-7143
AF98T018 thru AF98T020	Armament Directorate WI/MNPM (Dick Bixby) 101 West Eglin Blvd, Suite 140 Eglin AFB FL 32542-6810 (Dick Bixby, (850) 882-1281)	Lorna Tedder (850) 882-4296, x3399

FY98 AIR FORCE STTR TOPICS

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, BOLLING AFB DC

AF98T001	CANCELLED
AF98T002	Advanced Adhesives for Aerospace Structures
AF98T003	Microsatellite and Nanosatellite Propulsion
AF98T004	Optical Fiber Phenomena, Processing, and Devices
AF98T005	Combat Simulation Analysis of Advance Technology Weapons Concepts
AF98T006	Sensor Fusion for Image Display
AF98T007	Polymers for Flexible Electronics and Photonics
AF98T008	Real Time Intelligent Coaching for Command and Control
AF98T009	Novel Mathematical / Computational Approaches to Surveillance Image Transmission and Exploitation
AF98T010	Upgrading of PIC Codes for HPM Tube Design

WRIGHT LABORATORY – AVIONICS DIRECTORATE, WRIGHT-PATTERSON AFB OH

AF98T011	Innovative, Affordable Sensing for Aerospace Platforms
AF98T012	Automatic Target Recognition and Sensor Fusion Research
AF98T013	Military Essential Electron Device Development

WRIGHT LABORATORY – MATERIALS DIRECTORATE, WRIGHT-PATTERSON AFB OH

AF98T014	Simulation-Based Design System for Multi-Stage Manufacturing Processes
AF98T015	Carbon Nanotube Materials for Air and Space Applications
AF98T016	Evanescent Fields for High-Speed, Non-intrusive Materials Processing and Assessments
AF98T017	Polymeric-Based Materials and Polymer-Nanocomposites for Thermal Management and Electrical Signal Distribution of USAF Satellites and Aircraft

WRIGHT LABORATORY – ARMAMENT DIRECTORATE, EGLIN AFB FL

AF98T018	Weapon Flight Mechanics
AF98T019	Sensor Concepts for Autonomous Guidance
AF98T020	Ordnance Technologies for Advanced Munitions

Department of the Air Force
FY1998 STTR Topic Description

AF98T002 TITLE: Advanced Adhesives for Aerospace Structures

OBJECTIVE: Develop high temperature adhesives and low shrinkage adhesives for bonding airframe joints and to search for new NDI methods for the evaluation of joints bonded by these adhesives.

DECRIPTION: It is recognized that adhesive bonded joints have superior weight saving characteristics compared to bolted joints. Current aircraft construction uses thousands of rivets which contribute to a substantial weight fraction of the total airframe weight. Structural weight is often a critical design issue in modern military aircraft and missiles because it will determine the operational envelope such as speed and range, and on-board capabilities such as weapon load and "smartness" of the aircraft. In stealth applications, adhesive bonded structures, as opposed to riveted structures, are critical in controlling radar cross section in many areas. Additionally, these stealth structures require high temperature adhesives which are becoming a limiting factor that prevents successful development of light weight stealth airframe and engine components. Composite patch repair of aging aircraft is supposedly a superior repair meted because it does not require significant additional weight and drilling additional holes that weaken the original structures.

In spite of all these advantages, adhesive joining method is not widely used today because of a serious lack of scientific understandings in this technology and in certain cases, a lack of appropriate materials. So adhesive bonding is only used as a vary last resort. This is underscored by the fact that fasteners are added to adhesive repaired parts today to provide added insurance in mechanical integrity, thus negating the advantage of adhesive bonded joints. The new holes drilled for the fasteners, in addition to weakening the structures by acting as stress concentrators, are creating many additional maintenance issues such as fuel leakage.

This lack of confidence is due to a lack of Nondestructive inspection (NDI) method to distinguish a good bond vs. a bad bond. Bondline degradation is a critical concern but the mechanism is poorly understood and there is no reliable method to detect a good bond turning bad and/or to predict the residual bondstrength of an aged bond.

(1) New adhesives:- High temperature adhesives to meet Air Force requirements, and zero-shrinkage adhesives for minimizing internal stress at the bond line. New high temperature adhesive is needed to match the new high temperature composite capability. This is critically needed in stealth structures. The adhesive needs to be compatible with the matrix of the high temperature composite, but also possesses the right rheological behavior and processing parameters to function as an adhesives. Aromatic or heterocyclic aromatic structures with proper thermosetting functional groups will be investigated. It is well known that adhesive shrinks during cure, thus subjecting the polymer in the bondline to be in a constantly high state of tri-axial stress. This is a severe factor in limiting the bond strength of adhesive bonded joints. The shrinkage issue is also of critical importance to opto-electronic packaging because shrinkage causes misalignment of micron size optical elements, a critical issue to be addressed in improving the yield of opto-electronic devices.

(2) Pre-damage Nondestructive Inspection (NDI):- All existing NDI methods detect voids and cracks. A substantial comulation of chemical damage would have occurred prior to crack initiation. The strength of the bonded structure would have been compromised before the current NDI methods can detect any changes. These techniques are also inadequate to distinguish a good bond vs. a bad bond, e.g. a bond that has good chemical bonding between the adhesive and the adhered (cohesive failure in bonding test) vs. a "kissing bond" (adhesive failure in bonding test). New NDI methods (e.. high frequency dielectric measurement in the Ghz range) that prove the integrity of the chemical bonding between the polymer and the adhered instead of macroscopic continuity is needed.

PHASE I: Propose candidate materials for use as bonding adhesives. Conceptually demonstrate the superiority of these materials of those currently in use. Propose NDI techniques that can detect physical and chemical degradation of the bonded joints.

PHASE II: Use proposed adhesives in bonded joints and demonstrate their superiority via new NDI technique to test and validate bond strength and integrity.

PHASE III DUAL USE APPLICATIONS: Develop viable adhesives and evaluation techniques for commercial application in many forms of lightweight structures. Commercial applications are potentially numerous. Strong, light weight joints with reliable inspection techniques will be useful in many transportation systems including automobiles, ships and commercial aircraft.

REFERENCES:

1. "Structural Adhesives", A Report for National Materials Advisory Board, National Research Council, R. L. Patrick, Ed., Marcel Dekker, New York, 1976.
2. "Structural Adhesives", S. R. Hartshorn, Ed., Plenum Press, NY, 1986.

AF98T003 TITLE: Microsatellite and Nanosatellite Propulsion

OBJECTIVE: Develop micro-thrusters based on sub-micron-scale and larger that could produce impulse bits less than 10-9 nanoseconds for precision thruster applications. These thrusters should exploit non-conventional physical processes that occur at the sub-micron scale.

DESCRIPTION: Microsatellites and nanosatellites (defined as those lighter than 100 kg and 1 kg respectively) are gaining interest in the DOD community. The recent successes in micro-devices, such as fingernail-sized cameras, are leading to microspacecraft weighting as little as 5 kg. High-density digital electronics in smaller and smaller units translates into smaller and smaller space vehicles. However, no single factor constrains the design of space vehicles and the execution of their mission more than the state of art in propulsion technology. Micro-chemical propulsion can be used as a primary thrust system for orbit insertion, trajectory-control, and attitude control. Micro-electric propulsion may achieve some high delta-V maneuvers and attitude controls. Micro-thrusters based on sub-micron-scale and larger structures could produce impulse bits of less than 10-9 nanoseconds for precision thruster applications and could exploit non-conventional physical processes that occur at the sub-micron scale. Batch operation enables the generation of higher thrust levels and impulse bits by parallel operation of many individual micro-thrusters. Batch-fabrication also enables inexpensive replication of entire thruster modules in lots of several hundred. The objectives are cluster-built pulsed solid/gas propulsion systems, micro-ion, micro-pulsed plasma thrusters, micro-resistojets, and other possible alternatives.

Scaling available thrusters to the required sizes presents several problems since most macroscopic physics do not apply at the non-continuum micron-level scales. For example, the breakdown voltage of micro-plasma is not known, nor is the gas flow behavior in micro-nozzles. Micro-nozzles suffer from boundary-layer effects which become more dominant as the local Reynolds number decreases. The Maxwell equations may not be valid at this scales. New electromagnetic theory for micro scales may be necessary. More fundamental studies needs to be done in characterizing combustion and plasma dynamics in microscopic scales for future revolutionary micro-thrusters.

PHASE I: Design and test feasibility of proposed micro-thrusters.

PHASE II: Develop and test prototype of micro-thruster.

PHASE III DUAL USE APPLICATIONS: Increasing use of microsatellites for numerous commercial applications has made the entire area a growth industry. Micro-propulsion devices would have a wide range of customers not only in the industries associated with satellite technology but in other space applications.

REFERENCES:

1. Mueller, Juergen, Overview of Micropropulsion Workshop, Jet Propulsion Laboratory, 7 April 1997.

2. Janson, S. W. and Hevajian, H., "Batch-Fabricated Microthrusters: Initial Results," AIAA-96-2988, 32nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 1-3 July 1996.

AF98T004 TITLE: Optical Fiber Phenomena, Processing, and Devices

OBJECTIVE: Advance the applications of optical fibers in devices and systems of importance to the Air Force by studying phenomena, preparation and processing of fibers, and new fiber devices based on advanced processing techniques. Develop a better understanding of fiber materials phenomena and the interactions of fibers with optical radiation Develop new and better techniques for doping and controlling the doping profile of fibers, and new techniques for making special shape and special geometry multiple core fibers with controlled dopants.

DESCRIPTION: Optical fibers have emerging applications as lasers, distributed and point sensors, and signal processors, in addition to their better known applications in communications. In communication systems, fibers are finding increasing applications other than signals carrying such amplifiers, signal conditioners, filters, and multi- and demultiplexors. Most of the emerging applications of optical fibers depend on special properties of the fiber or its preparation. Examples include special doping and doping profiles, special shapes and configurations, such as multiple cores, and the ability to build in index of refraction variations (e.g. Hill gratings). This topic seeks to advance the important applications of optical fibers in devices and systems of importance to the Air Force by studying phenomena, preparation and processing of fibers, and new fiber devices based on advanced processing techniques. Of interest are better understanding of fiber materials phenomena and interactions of fibers with optical radiation, new and better techniques for doping and controlling the doping profile of fibers, and new techniques for making special shape and special geometry multiple core fibers with controlled dopants. Also of interest are better, more flexible techniques for writing gratings in fibers. Some of the techniques include, core and cladding; improved understanding of the physics and engineering of such fiber gratings, including direct writing of the gratings; the use of additional dopants and treatments, such as hydrogen loading in the fibers to increase the UV sensitivity and stability of fiber gratings; developing the ability to manufacture fiber gratings without having to strip and recoat the fiber; and control of the tensile strength of fiber gratings.

PHASE I: Propose and develop new concepts and identify the means for their implementation

PHASE II: Develop special fibers, demonstrate devices based on them, possibly with collaborators. and will supply prototype quantities of special fibers to others for device fabrication.

PHASE III DUAL USE APPLICATIONS: Apply improved fibers and better processing technologies to commercial applications in industry. Many customers are available for better technology in this area and fiber optics is a developing market. The telecommunications industry, medical industry, as well as the defense sector would all benefit by improved fiber optics materials and technology.

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1. Photosensitivity and Quadratic Nonlinearity in Glass Waveguides: Fundamentals and Applications, volume 22, 1995 OSA Technical Digest Series, (Optical Society of America, Washington, DC 1995)

2. Fiber Optic and Laser Sensors Nine, R.P. DePaula & E. Udd, ed, SPIE, Bellingham, WA (1992)

AF98T005 TITLE: Combat Simulation Analysis of Advance Technology Weapons Concepts

OBJECTIVE: Innovative concepts are sought to harness the growing capabilities of combat modeling and simulation (M&S) software to meaningfully quantify actual warfighting impact of proposed technical improvements to operational defense systems. It is desired to so advance the state of the art as to permit head-to-head quantified combat benefit comparisons before expenditure decisions are made to actually modify existing systems or to manufacture new ones.

DESCRIPTION: Research in areas such as directed energy weapons, low observables, electronic countermeasures, and sensors is driven by the desire to enhance the warfighting effectiveness of our combat systems. Predicting the magnitude of that enhanced combat capability in quantitative terms remains a subjective art. It remains virtual guesswork to predict the relative warfighting benefits of one proposed technical advance compared to a competing one. The high cost of such advanced technology acquisition programs encourages the search for a more objective evaluation methodology. One promising alternative is combat simulation software which would permit the R&D acquisition decision maker to directly examine the simulated effect of the proposed innovation on modeled combat systems in realistic war scenarios. Such software could enable the user to adjust targeted performance characteristics to gauge which incremental technical improvements offer the highest combat-effectiveness payoffs. Limited defense dollars could then be targeted to the higher payoff technology. Artificial intelligence should directly assist the selection of realistic points in parameter-space, the proper insertion of the new technology in all relevant weapons systems, and likely possibilities for enemy countermeasures. The resultant computational capability would also serve warfighters in formulating strategy and tactics for optimum employment of new capabilities entering the inventory.

PHASE I: Propose and study new approaches in simulation algorithms for both realistically reflecting the physical capabilities of new electronics-based technologies as well as evaluating their real world effects. Identify, justify, and fully characterize an optimal combat simulation software package that will serve as the basis for the eventual M&S evaluation system. The choice should be governed by ensuring maximum coverage of Air Force systems, user-friendly interface for non-computational users, and ease with which the evaluation-specific algorithms can be inserted. Formulate the methodology for accurately incorporating the effects of weapons system technology enhancements in said tactical and/or operational combat simulation software. Provide examples of the specific quantitative output which the final software will yield to aid technology acquisition decisions.

PHASE II: Innovate a complete prototype combat simulation software package which will permit the interactive insertion and evaluation of advanced technology capabilities in realistic warfighting environments and which will yield quantitative combat effectiveness impact output data to guide technology acquisition decisions.

PHASE III DUAL USE APPLICATIONS: The resultant software could be accepted as a standard for advanced technology acquisition evaluations throughout the Department of Defense as well as defense contractors. Furthermore the advanced internal logic of such a software package could be transferred to other baseline M&S software to facilitate similar acquisition decision making over a wide range of fields such as transportation, communications, and computer systems.

REFERENCES:

1. "TACtical SIMulation (TACSIM) Users Manual," TACSIM Project Office, Manassas, VA, 1995.

2. "Joint Exercise Driver for Intelligence (JEDI) Terminal Operations and Sample Messages Guide," Doc JED-VED-9400, Joint Warfighting Center, Hurlburt Field. FL, 1994.

3. "Digitizing the Future," DMA No. DDIPDIGITALPAC, Defense Mapping Agency, Fairfax, VA, 1992.

AF98T006 TITLE: Sensor Fusion for Image Display

OBJECTIVE: Develop Multi-spectral image display technology for use in military systems. Multi-spectral is meant to include polarimetric images within a single spectral band or non-image data that may be fused with image streams.

DESCRIPTION: Human capability for processing the ever-increasing volumes of multi-spectral images is in short supply. For example, imagery sources are increasing in number without a corresponding increase in the number of human image interpreters. In fact, there is real concern regarding the decrease in both the number and experience level of military imagery analysts. For example, multi-spectral images are increasingly available, but no standard for human viewing of multi-spectral images has yet been developed. Both the military and the commercial sectors have made large investments in algorithms for the automated exploitation of multi-spectral imagery. Many of these algorithms employ non-intuitive computations, such as the ratio between pixel intensities in specific wavelength bands. The human interpreter is provided with no capability to verify the results of the automation. Such difficulties are expected to worsen as hyper- and ultra-spectral imaging systems continue to mature. This topic seeks proposals to discover new image processing technologies based on human and biological image processing. Human and other biological systems are known to process images in multiple spectral bands that are held in registration during target recognition and navigation. Further, many of the processing steps of human vision are known and have been formally described, often in terms of algorithms for image processing. This topic encourages the extension of algorithmic descriptions of human multi-spectral image processing to the domain of image display processing. The overall technology objective is a display of fused multi-spectral images with measurable advantages for human tasks of interpretation and navigation. Secondary technology objectives include real-time image processing, feature and target segmentation, and wearable, head-mounted, displays. Technology challenges include: (1) spatial registration of multi-spectral static and moving image streams, (2) dynamic range compression or normalization to prevent display saturation, (3) false coloring of fused images for improved human image segmentation and target recognition, (4) benchmark tasks to enable quantitative comparison of various solutions to problems of human image processing performance in recognition and navigation.

PHASE I: Construct algorithms for false color display of multi-spectral image data.

PHASE II: Do studies to determine image rendering best suited for tasks of recognition and navigation given state-of-the-art cockpit environment.

PHASE III DUAL USE APPLICATIONS: Improved technology for displays for multi-spectral images would benefit several domains where multi-spectral images are encountered, including: agriculture, for satellite image processing for crop identification and yield estimation; medicine, for medical imaging of combined MRI and X-ray data, for example; weather, for imaging of wind and temperature in combination, for example; and others.

AF98T007 TITLE: Polymers for Flexible Electronics and Photonics

OBJECTIVE: Develop the materials and processing methodology for developing flexible electronic, and photonic devices.

DESCRIPTION: Many advanced systems and smart structures will require low cost conformal and/or flexible electronic and/or photonic circuitry. Examples of these applications include conformal phase array antenna and receivers, ergonomical head-mounted displays for Air Force pilots, flexible displays, deformable smart wings or structures for aircraft, microsatellites and small size unmanned aerial vehicles (UAV). Polymers are well known for their low cost processing and their mechanical integrity. With the recent surge on functional properties research in polymers, they have been shown to possess interesting electronic and photonic properties. This class of materials is ideal for developing flexible electronic and photonic components, devices and even systems for the above mentioned applications. Electronic properties of polymers can be controlled to be insulating, semiconductive and conductive. Photonic properties include electro- and photo- induced luminescence, nonlinear optical and photovoltaic properties. Polymer is the enabling technology for the fabrication of today's microelectronics. Combining photolithography techniques with other polymer fabrication technologies such as printing, low cost flexible circuitry that are all polymer based are viable. Flexible electronic and photonic circuitries that include polymeric transistors, diodes, capacitors, light emitters and detectors, diode lasers, electronic and photonic interconnects are possible products of this technology. Through this research we seek to develop materials, and processing and fabrication methodologies that will allow the fabrication of conformal circuitries on flexible substrates. Research should focus on those materials that can combine the appropriate properties with the necessary processing characteristics for flexible electronic and photonic applications.

PHASE I: Synthesize or obtain material systems that possess the proper functional and mechanical properties, and processing characteristic for use in flexible devices. Conceptually demonstrate the feasibility of fabricating a flexible device or structure suitable for demonstration.

PHASE II: Using new materials, modify the material systems as necessary to optimize the properties. Investigate processing methodology for viable commercial development. A flexible device or structure suitable for demonstration will be fabricated to test the integration of the results of material research and processing investigation.

PHASE III DUAL USE APPLICATIONS: Flexible electronics and photonics have numerous private sector applications. The technologies addressed in this topic can be used in communications, computers, printers, household appliances, commercial electronics and display systems.

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1. D. T. Grubb, I. Mita and D. Y. Yoon, Materials Science of High Temperature Polymers for Microelectronics, MRS Symposium Proceedings, Vol. 227, 1991.
2. C. P. Wong (ed.) Polymers for Electronic and Photonic Applications, Academic Press, 1993.

AF98T008 TITLE: Real Time Intelligent Coaching for Command and Control

OBJECTIVE: The development of Multi-spectral image display technology for use in military systems. For purposes of this topic, multi-spectral is meant to include polarimetric images within a single spectral band or non-image data that may be fused with image streams.

DESCRIPTION: Human capability for processing the ever increasing volumes of multi-spectral images is in short supply. For example, imagery sources are increasing in number without a corresponding increase in the number of human image interpreters. In fact, there is real concern regarding the decrease in both the number and experience level of military imagery analysts. For example, multi-spectral images are increasingly available, but no standard for human viewing of multi-spectral images has yet been developed. Both the military and the commercial sectors have made large investments in algorithms for the automated exploitation of multi-spectral imagery. Many of these algorithms employ non-intuitive computations, such as the ratio between pixel intensities in specific wavelength bands. The human interpreter is provided with no capability to verify the results of the automation. Such difficulties are expected to worsen as hyper- and ultra-spectral imaging systems continue to mature. This topic seeks proposals to discover new image processing technologies based on human and biological image processing. Human and other biological systems are known to process images in multiple spectral bands that are held in registration during target recognition and navigation. Further, many of the processing steps of human vision are known and have been formally described, often in terms of algorithms for image processing. This topic encourages the extension of algorithmic descriptions of human multi-spectral image processing to the domain of image display processing. The overall technology objective is a display of fused multi-spectral images with measurable advantages for human tasks of interpretation and navigation. Secondary technology objectives include real-time image processing, feature and target segmentation, and wearable, head-mounted, displays. Technology challenges include: (1) spatial registration of multi-spectral static and moving image streams, (2) dynamic range compression or normalization to prevent display saturation, (3) false coloring of fused images for improved human image segmentation and target recognition, (4) benchmark tasks to enable quantitative comparison of various solutions to problems of human image processing performance in recognition and navigation. For purposes of this topic, multi-spectral is meant to include polarimetric images within a single spectral band or non-image data that may be fused with image streams.

PHASE I: Suggest and design embed intelligent decision aids for workstations for command and control.

PHASE II: Determine system performance benefits of embedded decision aids.

PHASE III DUAL USE APPLICATIONS: Displays for multi-spectral images would benefit several domains where multi-spectral images are encountered, including: agriculture, for satellite image processing for crop identification and yield estimation; medicine, for medical imaging of combined MRI and X-ray data, for example; weather, for imaging of wind and temperature in combination, for example; and others.

AF98T009 TITLE: Novel Mathematical/Computational Approaches to Surveillance Image Transmission and Exploitation

OBJECTIVE: Provide wide-ranging new capabilities in treatment of image data from surveillance and reconnaissance, enhancing ability rapidly to communicate and interpret such data, based on creative mathematical and computation innovations.

DESCRIPTION: The treatment of pictorial images has long relied on transform methods, especially in connection with their properties relative to statistical characteristics (stochastics) of the population of scenes, and the ambient environment. Insights from group theory and algebra, representations, function spaces and higher-dimensional geometry have already had an impact on both the computational feasibility of the transforms involved (e.g. Fourier, Karhunen, Walsh, Hadamard, Mellin and Hough transforms) and on the means of taking into account and compensating for statistical uncertainty. Further work in this area is needed, and proposals addressing progress here is encouraged. Suitable algebraic structures indicate how transform computations can be performed much faster (done in parallel). New types of generating bases for signal spaces are tools for improved image compression, reconstruction and feature identification. Geometric reasoning and database management of shapes permit drastic reduction in transmitted scene descriptors. The enhanced understanding arising from development of

original mathematical relationships should lead to algorithms of greater power that realize more efficient and usable transmission, storage, and depiction of images that are obtained through surveillance both in peace and in conflict. Preference will be given to proposals that show evidence of mathematical depth as well as hands-on familiarity with applications of essential importance to the Air Force, and that convey a credible road-map or plan for technical insertion of results.

PHASE I: Develop a framework for algorithm development including published foundational results. Code an initial application on a low-level platform (such as a PC) to demonstrate feasibility of the concept.

PHASE II: Develop realistic image exploitation algorithms from the framework/methodology delineated in Phase I. Extend both the framework and the algorithms to deal with multiple sensing paradigms, data diversity, non-gaussian and malicious clutter environment, and a range of transmission channel requirements. Perform rigorous algorithm instantiation and testing using real-world field data.

PHASE III DUAL USE APPLICATIONS: Salient applications including secure and faithful encoding for wireless transmission of medical image or financial transaction information could be impacted. Commercial markets which involve space-based and aerial photography and radar sensing for economic, weather, and agricultural forecasting are expanding.

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1. "Spatial Signal-Processing in Radars and Sonars", T. Kadota in Spatial Statistics and Digital Image Analysis, National Research Council Report, August 1993
2. "Wavelets in Signal Processing Applications", AFIT/AFOSR Joint Workshop Proceedings, 12-13 March, 1992

AF98T010 TITLE: Upgrading of PIC Codes for HPM Tube Design

OBJECTIVE: This effort seeks a mathematically and physically rigorous refinement and extension of existing plasma simulation codes (Particle-In-Cell Codes). The operational goal is the provision of an improved plasma simulation tool for high power microwave tube design.

DESCRIPTION: In present plasma simulations Maxwell's equations are used along with the Newton-Lorentz equations of motion. The latter routinely neglects the retarding force of the EM field carried along by the "particle" (the electron self-force) and this error is considerable at the high particle speeds common in HPM tubes. Another source of error in these tube design codes is secondary emission phenomena together with other tube boundary conditions. Finally, present plasma simulation methods partition a seamless physical interaction into separate components and no rigorous proof that the partitioned algorithm converges to a physically correct solution is available.

PHASE I: A persuasive strategy for numerically including the electron self-force into a PIC Code together with proper boundary conditions and a rigorous error analysis of both features.

PHASE II: A user-friendly commercially attractive code capable of doing HPM tube designs.

PHASE III DUAL USE APPLICATIONS: An appropriate commercial application for demonstration of the Phase II goals is the improvement (higher output and lower power consumption) of the magnetrons which drive microwave ovens and civilian radars.

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1. Yaghjian, "Relativistic Dynamics of a Charged Sphere", Springer-Verlag
2. Birdsall and Langdon, "Plasma Physics via Computer Simulation", Institute of Physics Publ
3. Lorentz, "The Theory of Electrons", Dover
4. Rohrlich, "Classical Charged Particles", Addison-Wesley

AF98T011 TITLE: Innovative, Affordable Sensing For Aerospace Platforms

OBJECTIVE: Introduce innovative concepts into the research and design of current and future avionics sensor suites that can satisfy stringent life-cycle cost and functionality requirements.

DESCRIPTION: This topic area encompasses radio frequency (RF), electro-optic (EO), as well as multispectral sensors. Robust and novel sensing approaches are sought. Low cost per function and open architecture sensing is required. Some platforms will be operational for as much as 80 years, so approaches to maintain and modernize the sensor suite are required. All sensing approaches, including microwave and electro-optical sensing should be considered. Radiating and non-radiating sensing approaches are included. Adaptable analog and digital sensing components similar to Field Programmable Gate Arrays (FPGAs) in the digital world should be considered. Maximum use of commercial components is an approach to low cost, but the brief lifetime of commercial parts availability must be addressed. Sensing tasks to be performed include both Air-to-Air and Air -to-Ground target acquisition and identification. Aircraft, unmanned aerial vehicles (UAVs), and space-based sensors should be

considered. Acquiring and identifying difficult targets that are concealed, camouflaged or low observable should be considered. Remote novel sensing approaches for targets that are under bridges, under foilage, or even underground, are desired.

PHASE I: Develop the novel sensing approach through quantitative models, design, or schematics, as applicable. Generate breadboard-level, proof-of-concept demonstrations or virtual prototype incorporating realistic data.

PHASE II: Conduct advanced demonstrations of novel sensing techniques using real data. Demonstrate feasibility for specific field application for both a military and commercial market.

PHASE III DUAL USE APPLICATION: The goal of open-architecture subsystems and low cost per function enhance the applicability of these novel sensing techniques for various commercial markets. Applications include biomedical imaging, remote sensing for environmental hazards, automobile sensors (e.g. collision avoidance), and commercial communication systems.

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1. "Study Sees USAF Based On Esoteric Technologies", Aviation Week Space Technology, 19 August 1996, v. 145, no. 8, p 80.

2. "A Systems Engineering Approach to Aircraft Kenetic Kill Countermeasures Technology: Development of an Active Aircraft Defense System for the C/KC-135", AFIT Thesis AFIT Reference AFIT/GSE/ENY/95D-01, ADA306012, Approved for Public Release

3. "Registration and High Resolution Reconstruction of Multi-Frame Low-Resolution, Aliased Infrared Images", SPIE Passive Sensors Conference Proceedings, April 1996.

4. Wright LaboratorySensor Technology Branch (WL/AAJT) Home Page (Public Release Articles with Abstracts) at http://www.aa.wpafb.af.mil/aanew/aaj/aajt/index.html

AF98T012 TITLE: Automatic Target Recognition And Sensor Fusion Research

OBJECTIVE: Develop automatic target recognition and sensor fusion approaches that are robust to difficult conditions, scale with problem complexity, and have tractable training requirements.

DESCRIPTION: Machine aided or automatic target detection and recognition needs an approach grounded in fundamental single and multi-sensor phenomenologies. This basic approach contributes to a future ability to identify difficult targets (e.g., adverse weather, obscured, camouflaged, articulated, . . .) over large areas to support timely sensor to shooter operations. Methods which develop affordable sensor solutions by balancing sensor complexity across single and multi-sensor approaches are desired. Further, methods which address robust to difficult conditions, scale with problem complexity, and have tractable training and testing requirements are of fundamental interest. To achieve these important objectives, approaches with a strong model-based component should be developed in such a way that limited testing can be used to validate the underlying model assumptions (theoretical basis) of the approach. This will build confidence that the approach will work in conditions that are not testable due to the extreme complexity of the real world conditions.

PHASE I: The first phase of the program should result in a paper design of a single/multi-sensor ATR algorithm suite that can demonstrate, either theoretically or via simulation, that the objectives of robustness, scalability, and tractable training/testing requirements can be met. Quantitative estimates that show advantages of proposed approaches in terms of amount of measured data required to support approach, memory requirements (e.g., storage requirements for target templates), and computational requirements (e.g., number of operations required to classify target for a typical but clearly defined problem) are desired. This design will be implemented and tested in Phase II.

PHASE II: Algorithms will be developed, tested and delivered to the government for evaluation and incorporation into automatic target recognition and fusion testbeds. Algorithms should be tested with a combination of synthetic and measured data provided by the government. The algorithms should be delivered for government integration and installation.

PHASE III DUAL USE APPLICATIONS: Automatic target recognition and fusion approaches have significant application in the fields of medical imaging, remote sensing, automated manufacturing and inspection, traffic control, and law enforcement. Algorithms developed as result of this effort will likely support these and other applications where sensing and process control are key technical elements.

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1. T.D. Ross, L. Westerkamp, E.G. Zelnio, T.J. Burns, "Extensibility and other model-based ATR evaluation concepts," Algorithms for Synthetic Aperture Radar Imagery IV, Proc. SPIE 3070, Vol. 3070

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AF98T013 TITLE: Military Essential Electron Device Development

OBJECTIVE: Develop the fundamental materials techniques, models and tools required for advancing electron device technologies.

DESCRIPTION: While many advanced electron devices require the assets of a large company for their manufacture, there are supporting technologies such as epitaxial wafers, modeling/simulation/design tools, and fabrication services which are often provided by small businesses. There are also some cases in which small businesses do manufacture the device types of interest. These include, but are not limited to: microwave/millimeter wave power amplifiers and integrated circuits; high speed/high resolution/high accuracy/broadband analog to digital converters; infrared and/or ultraviolet detectors, focal plane arrays and lasers; and highly microminiaturized components, consisting of electronic chips and devices combined via advanced multi-chip module packaging techniques. The technical limitations of such devices often stem from such diverse areas as fundamental materials growth and evaluation techniques, basic photo-electro-thermo-mechanical models, fundamental device models, design tools and environments, basic device processing techniques, and test and analysis. Advancement of the frontiers in these basic sciences and technologies has historically enabled similar advances in commercial technologies across a broad front of devices which have found applications in consumer electronics. Examples of potential projects in this broad area might include application of advanced materials to conventional devices to achieve higher performance or yield, development of needed modeling or design tools, or development of processes for reducing the cost of devices or module chip modules.

PHASE I: Demonstrate proof-of-principle for advancement of one or more of the limiting factors.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might impede successful adaptation of the advancement of one or more of the limiting factors.

PHASE III DUAL USE APPLICATIONS: Commercial applications could include high bandwidth communications systems, automotive radar, intelligent highway sensor systems, wireless local area network electronics, high density data storage, surgical devices, high speed printing, and commercial avionics.

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1. A. Cho, "Advances in Material Processing and Device Fabrication," presented at the 2nd International Semiconductor Device Research Symposium (ISFRS '93), pp. 7-8 (1993).
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4. T. Jenkings, C. Bozada, et al., "Power Performance of Thermally-Shunted Heterojunction Bipolar Transistors." 1997 IEEE MTT-S International Microwave Symposium Digest, pp 949-952, 1997.
5. B. Glance, et al., "Fast Frequency-Tunable External-Cavity Laser," Electronics Letters Vol. 23, No. 3, pp. 98-99, 20 Jan 97.

AF98T014 TITLE: Simulation-Based Design System for Multi-Stage Manufacturing Processes

OBJECTIVE: Develop a computer-aided approach for the design of reliable and affordable manufacturing processes for difficult-to-form materials that considers alternative materials, sequences of processes, and process parameters.

DESCRIPTION: Manufacturing of components for new aircraft systems such as the F-22 and spare components for aging aircraft systems offers great opportunity to introduce innovative material process design methods which consider alternative processing approaches and can lead to significant improvements in component reliability and affordability. Of particular interest is the development of computer-aided design tools that enable the standardization and optimization of the supply chains for parts used by Air Force systems while conforming to proven principles for the design of material processes. This effort will involve the formulation of materials and processing models and their use with simulation and optimization-based design techniques in order to determine processing sequences and parameters that optimize the manufacturing process with respect to quality, performance, and cost.

PHASE I: Demonstrate feasibility of obtaining and utilizing materials and process models in a computer-aided design system that can evaluate, for optimization, alternative processing sequences for product quality, cost, performance, and delivery time. Develop a feature-based framework for modeling and optimization that allows for the addition of new material, process models, and optimization algorithms. Develop methods based on shape optimization for the standardization of billets and intermediate shapes for metal forming of multiple final shapes. Verify the capabilities of developed tools by using models for the manufacturing of aircraft components such as turbine disks.

PHASE II: Develop a prototype design system capable of evaluating alternative thermal, mechanical, and/or chemical processes for the production of net-shape components from difficult-to-form materials. The design system's user interface will

make extensive use of visualization features. Verify process design system capabilities by optimizing for cost, quality, performance, and delivery time, the manufacturing of engine and structural components.

PHASE III DUAL USE APPLICATIONS: This exploratory research is foreseen to be used in both military and commercial applications for the design and optimization of material, shape, and processing aspects of manufacturing from high performance metals, ceramics, and polymers. Immediate benefits will be obtained from the application of shape optimization techniques to the standardization and optimization of the Air Force supply chain. A specific example includes minimizing the number of billet types and blocker dies involved in forging different turbine disks for all Air Force systems.

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AF98T015 TITLE: Carbon Nanotube Materials for Air and Space Applications

OBJECTIVE: Develop novel carbon nanotubes for macro-to-submicro applications

DESCRIPTION: A strong effort in the synthesis and theory of fullerene nanotubes is very timely [Physics Today, June & September 1996; C&E News, July, 1996, American Scientist, July, 1997]. The unique mechanical and electronic properties of this new class of materials enable a wide variety of potential technological applications, especially new composite materials for spacecraft and aircraft of interest to the United States Air Force. Doubling of the stiffness of the fiber accompanied by a corresponding decrease in weight, may enable a significant reduction in cost of materials. Indeed, the development of "molecular composites" which has been recognized as critical for Air Force applications for many years, has eluded the technological community so far. Moreover, tubular ropes would enable the use of such high strength materials for space applications. A broad spectrum of additional applications encountered at the micro to nano level are also of potential interest, for example, as future submicroelectromechanical (MEMS) systems.

This project is to develop and apply the challenging technologies to grow and process carbon nanotubes as required, as well as providing a strong theoretical basis, combining first principles, atomistic simulations and continuum-shell models. This will allow the handling of large systems and identification of general relationships [Yakobson et al., Physical Review Letters "Nanomechanics of Carbontubes" 76, 2511 (1996)] to enable the prediction of properties and the design of nanotubes of defined structures. For example, the proposed project will address the prediction of properties of multiwalled nanotubes, which depend critically on the interlayer coupling via van der Waals interactions, in contrast to the single-shell tubes. Similarly, the inter-tubular interactions in ropes [Smalley et al., Science, "Crystalline ropes of metallic carbon nanotubes," 273, 483 (1996)] as well as the tubule-matrix interactions in composites, are largely due to vdW forces, which have to be incorporated in the molecular dynamics model.

PHASE I: Design, synthesize and demonstrate feasibility and manufacturability of fullerene nanotubes with improved properties.

PHASE II: Design, synthesize and characterize an expanded series of carbon nanotubes based on proof of principle studies in Phase I.

PHASE III DUAL USE APPLICATIONS: This technology will have broad commercial applications involving, among others, air and space structures, microelectronics, and submicroelectromechanical (MEMS) systems.

AF98T016 TITLE: Evanescent Fields for High-Speed, Non-intrusive Materials Processing and Assessments

OBJECTIVE: Develop a capability for fast, reliable and affordable morphologic and topographic material process monitoring and assessment.

DESCRIPTION: Recent advances in sensor technology (e.g., in situ remote raman, IR, optical emission spectroscopy, chemical sensing, etc.) have made significant contributions to real-time monitoring and control of material (gas, liquid, and solid) composition and phase. New sensor technologies (in particular, spectroscopic methods) are moving in situ process monitoring from macroscopic energy measurements of temperature and pressure toward more nano-scale crystallographic data providing more fundamental, broad-based information for deriving and/or inferring in situ material behavior and resultant properties. Such remote, non-intrusive methods are also needed for both in situ morphology and topographic mapping of 2D and ultimately 3D films, as well as post process for fast, reliable, and affordable damage assessment of aerospace system structural integrity. Evanescent fields are used in scanning tunneling microscopes in the form of evanescent electron wave functions achieving atomic-scale topological resolution. Evanescent fields are also used in scanning near field optical microscopes achieving resolutions on the order of 10-100 Angstroms using a light with 6000 Å (red) wavelength. Evanescent fields provide a means of interaction through an interface, and they usually yield very high resolution in excess of the Abbe barrier. The need exists for a high-speed, portable, lightweight, harsh environment (500 C) evanescent field probe, that can be used, either handheld or via robotic manipulator, to characterize surface and subsurface texture variations in thin-films, and to detect various types of degradation and/or discontinuities in bulk materials, e.g., bondline degradation in polymeric composites and metal fatigue cracks in turbine engine components. The challenge is to transfer evanescent field technology from laboratory material characterization applications to a cost competitive material process monitoring and/or assessment capability.

PHASE I: Demonstrate the feasibility of material monitoring and/or assessment across a broad range of temperature, processing and operating conditions to monitor morphology, flaws and stresses of thin-film and structural materials. Performance enhancement films of replacement components for aging aircraft to include high temperature intermetallics, composites, and inorganic electro-optical materialsare immediate interest.

PHASE II: Develop a cost-competitive, fast and reliable capability for near real-time monitoring and/or assessment across a broad range of processes and conditions to monitor morphology, flaws and stresses of thin-film and structural materials.

PHASE III DUAL USE APPLICATIONS: Dual use of this exploratory research is foreseen for the process monitoring and post process assessment of aerospace materials. More specifically, thin-films for extreme environments such as thermal and wear protection for automotive, aircraft, and/or space propulsion systems. Specific examples include morphologic and topographic monitoring of thin-film or bulk material surfaces, and for coating, cleaning or inspecting of aircraft components.

REFERENCES:

1. A. Garcia, and M. Tabib-Azar, "Sensing Means and Sensor Shells: A New Method of Comparative Study of Piezoelectric, Piezoresistive, Electrostatic, Magnetic, and Optical Sensors." Sensors and Actuators A. Physical Vol. 48 (2), pp. 87-100 (1995).
2. U. Durig, D. W. Pohl, and F. Rohner, J. Appl. Phys. 59, 3318 (1986).
3. Ash, E. A. and Nicholls, G., Nature 237, 510 (1972).

AF98T017 TITLE: Polymeric-Based Materials and Polymer-Nanocomposites for Thermal Management and Electrical Signal Distrubtion of USAF Satellites and aircraft

OBJECTIVE: Develop a new generation of polymer-based materials and nanocomposites for thermal management and electrical signal distribution for USAF satellites and aircraft.

DESCRIPTION: Proper thermal management and efficient electrical signal distribution are critical for successful operation of USAF systems in all environments and theaters. However, many current approaches for thermal management rely on metallic heatsinks whose excess weight decreases operational payload. Likewise, existing approaches for electrical signal distribution rely on wires consisting of highly conductive metals such as copper, silver or metallic alloys whose high density, e.g. 10.5 g cm-3 for silver and 8.96 g cm-3 for copper, is undesirable for applications in space and aerospace vehicles where weight savings are important. It has been attempted to replace the 22 gauge copper wire currently used in aerospace vehicles with a smaller 26 gauge or 30 gauge wire, but the thinner wires do not have the necessary mechanical strength and durability and therefore cannot be used. Nevertheless, these metals afford the highest conductivity (approximately 6x105 S cm-1 at room temperature) for power, signal and EMI shielding applications

In an attempt to address these limitations, considerable research effort during the past twenty years has been spent on conducting polymers. Conjugated polymers such as polyacetylene, polythiophene and polypyrrole have been introduced with electrical conductivity up to 105 S cm-1 by chemical and electrochemical doping. However, these highly conductive doped conjugated polymers are environmentally unstable, exhibit poor mechanical properties and, therefore, have found limited applications, or none where high conductivity is required.

New materials technologies are sought which can give thin, highly conductive, low density wires compared with conventional coating and plating technologies or materials incorporating micron-sized metallic fillers. The main advantage to systems is the replacement of metal signal wires in existing aircraft and satellites resulting in a substantial weight savings, improved reliability and enhanced system performance. Other outlets include EMI shielding and grounding. The resulting technology should offer high thermal conductivity as well for thermal management applications.

PHASE I: Demonstrate innovative materials technologies which offer highly conductive (> 10**3 S/cm) wires or fibers having dramatically reduced densities from copper or silver. The wires must have adequate tensile strength (> 350 ksi) and modulus (> 10 msi) as well as thermal and environmental stability.

PHASE II: Demonstrate and develop continuous production capability of materials technologies demonstrated in Phase I. Establish consistent production criteria to give reproducible properties and produce ample material for AF testing.

PHASE III DUAL USE APPLICATIONS: Successfully demonstration would offer a tremendous potential for substantial weight savings on commercial aircraft and improved reliability of many consumer electronics.

AF98T018 TITLE: Weapon Flight Mechanics

OBJECTIVE: Demonstrate microelectromechanical aerodynamic flow control and develop neural network hypersonic aerodynamic prediction capability.

DESCRIPTION: Recent work in the application of Microelectromechanical Systems (MEMS) devices to aerodynamics has shown that MEMS devices have the potential to control air vehicles by manipulating the flow in the thin boundary layer attached to the aerodynamic surface. While micro-machining technology has enabled the miniaturization of sensors and actuators (small flaps) with high spatial and temporal resolution, lacking are self contained integrated systems of sensors, actuators, and processors to carry out real time flow control. The purpose of this research effort is to demonstrate the feasibility of integrating microsensors, microactuators, and decision-making microelectronics logic into the skin of an air vehicle to reduce drag and control the aerodynamic forces and moments on the body. The proposed technology will facilitate the development of next generation super-maneuverable air vehicles. A hypersonic weapon system will require the generation of extensive aerodynamic data through a combination of wind tunnel testing, computational fluid dynamics (CFD), and flight testing. However, flight testing of hypersonic vehicles at hypersonic velocities is extremely expensive, in some cases exceeding ten million dollars per flight. Researchers must depend on engineering analysis tools for preliminary design and CFD for advanced analysis. These techniques have limitations of their own. A thorough aerodynamic and aerothermodynamic analysis of hypersonic weapons will require a suite of data collection/ generation methods to provide a complete database. Development of a neural network based hypersonic prediction method will allow an efficient method to provide accurate aerodynamic prediction.

PHASE I: Provide fundamental understanding of the MEMS based aerodynamic measurement and control approach. The goal of the neural network research is to provide a capability of predicting hypersonic aerodynamic forces and moments on simple geometries.

PHASE II: Design and fabricate a self sustained distributed network of totally integrated MEMS devices on an air vehicle. Phase II for the neural network research is to conduct predictor training and validation using existing database on complex geometries.

PHASE III DUAL USE APPLICATIONS: The technology developed in this program has many commercial and military applications. MEMS technology could be used to develop weapon systems that do not need traditional aerodynamic control surfaces. This could lead to increased speed, range, and survivability of these systems. In the area of commercial aircraft safety, MEMS devices could be used to sense the onset of stall and prevent flow separation from wings and tail surfaces. This could aid in the prevention of airplane crashes. Neural network research could also aid the commercial aircraft arena, through improved simulation capability of flight performance.

REFERENCES:

1. A.A. Berlin and K.J. Gabriel, "Distributed MEMS: New Challenges for Computation," IEEE Computational Science & Engineering, pp. 12 - 16, January - March 1997.

2. K.F. Bohinger, B.R. Donald, N.C. MacDonald, G.T.A. Novacs, and J.W. Suh, "Computational Methods for Design and Control of MEMS Micromanipulator Arrays," IEEE Computational Science & Engineering, pp. 17 - 29, January - March 1997.

3. W. Faller, W. Smith, R. Nigon, and T. Huang, "Six Degree of Freedom Maneuvering Simulation of an Experimental Model Undergoing Severe Maneuvers Using Recursive Neural Networks," AIAA 96-2492, presented at 14th Applied Aero Conference.

AF98T019 TITLE: Sensor Concepts for Autonomous Guidance

OBJECTIVE: Develop innovative sensor concepts for guidance technologies for air deliverable autonomous munitions.

DESCRIPTION: The Advanced Guidance Division of the Wright Laboratory Armament Directorate seeks new and innovative ideas/concepts in areas associated with sensors/seekers for guidance and control applications for autonomous precision guided conventional munitions: electro-optical, millimeter-wave, and radio-frequency seeker technology and the components and signal processing systems used in such seekers. This includes, but is not limited to, sources, detectors, polarization-sensing elements and systems, modulators (both single element and pixelated), pattern recognition and processing systems, and basic material and device development for accomplishing all of these; and innovative signal and image processing algorithms used, for example, in synthetic-aperture radar (SAR), millimeter-wave (MMW), imaging infrared (IIR), and laser radar (LADAR), needed to autonomously detect, recognize, classify and identify target signatures embedded in sensor data. Sensors, algorithms, and integrated seeker concepts capable of processing/fusing multi-sensor data are of particular interest. Concepts must have dual use/commercialization potential.

PHASE I: Determine the technological or scientific merit and the feasibility of the innovative concept.

PHASE II: Produce a well defined deliverable product or process.

PHASE III DUAL USE APPLICATIONS: The military end products or processes resulting from this topic will be used to develop electro-optical, millimeter-wave, radio-frequency seeker technology, and the components and signal processing systems used in such seekers for autonomous guided munitions. A wide range of commercial products could be produced from this research. Typical applications include real-time imaging, machine vision, robotics, telemedicine, object recognition, telesurveillance, spectral medical imaging, remote sensing, laser cutting, molding and medicine. The commercial application should be formulated during Phase I. Phase II will require a complete commercialization plan.

AF98T020 TITLE: Ordnance Technologies for Advanced Munitions

OBJECTIVE: Develop and demonstrate technologies for enhancing existing munitions while providing a product for advanced munition applications.

DESCRIPTION: Ordnance technologies which reduce cost and support requirements, while improving performance, are needed for improving existing munitions and enabling future weapons. Technologies of interest support fuze, warhead and explosive technology advancements. Technologies of primary interest are: fuzing technologies which improve firing capacitors energy densities through the use of dielectric films developed from blending polymers with ceramic nanoparticles, processes for determining the mechanical properties of explosives and supporting test procedures and equipment, Metallic Oxide Semiconductor (MOS) thyristor based high power, fast rise time switches for use in munition firesets, technologies for controlling the terradynamic trajectories of geological probes and technology for demilitarization of high explosives using molten salt catalyst processes.

PHASE I: Complete design and laboratory or breadboard demonstration of technology.

PHASE II: Fabricate and test prototype devices, hardware and processes; deliver product for government testing.

PHASE III DUAL USE APPLICATIONS: Military applications include producing more effective munitions and lower collateral damage, that is it supports the Air Force precision engagement core competency . Commercial applications include compact, portable high voltage power supplies; processes for safety qualification of commercial explosives; switch mode power supplies for lasers, radars, and televisions; commercial earth resource monitoring devices; and hazardous medical, municipal, and organic waste elimination.

REFERENCES:

1. "Blunt Cylinder Impact Tests for the Determination of Constitutive Equations of Explosives", 15th International Symposium of Ballistics, Jerusalem, Israel, 21-24 May 1995.
2. "Lock-on Effect in Pulsed-power Semiconductor Switches", Journal of Applied Physics, 15 Mar 92, Volume 71, page 3036.
3. "500 Volt IGBTs Useful in High Voltage Hard Switching Applications", Electronic Design Magazine, Analog Applications Issue, Jun. 94.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Proposal Submission

DARPA's charter is to help maintain U.S. technological superiority over, and to prevent technological surprise by, its potential adversaries. Thus, the DARPA goal is to pursue as many highly imaginative and innovative research ideas and concepts with potential military and dual-use applicability as the budget and other factors will allow.

The topics published in this solicitation are broad in scope. They were developed to bring the small business community and research partners together to meet the technological needs of today. DARPA has identified 7 technical topics, numbered **DARPA ST98-001** through **DARPA ST98-007** to which small businesses may respond in the fiscal year (FY) 98 solicitation. Please note that these topics are UNCLASSIFIED and only UNCLASSIFIED proposals will be entertained. These are the only topics for which proposals will be accepted at this time. Full topic descriptions, which originated from DARPA technical offices, are included.

Please note that **5 copies** of each proposal must be mailed or hand-carried; DARPA will **not** accept proposal submissions by electronic facsimile (fax). A checklist has been prepared to assist small business activities in responding to DARPA topics. Please use this checklist prior to mailing or hand-carrying your proposal(s) to DARPA. Do not include the checklist with your proposal.

It is expected that the majority of DARPA Phase I awards will be Firm Fixed Price contracts. Phase I STTR proposals **shall not exceed $99,000**, and are for approximately one (1) year efforts. DARPA Phase II proposals must be invited by the respective Phase I technical monitor (with the exception of Fast Track Proposals - see section 4.5). Phase II STTR awards will be limited to $500,000, and it is expected that a majority of the Phase II contracts will be Firm Fixed Price-Level of Effort.

The responsibility for implementing DARPA's Small Business Technology Transfer (STTR) Program rests with the Office of Administration and Small Business (OASB). The DARPA SBIR/STTR Program Manager is Connie Jacobs. DARPA invites small businesses, in cooperation with a researcher from a university, an eligible contractor-operated federally-funded research and development center (FFRDC), or a non-profit research institution, to send proposals directly to DARPA at the following address:

DARPA/OASB/STTR
Attention: Ms. Connie Jacobs
3701 North Fairfax Drive
Arlington, VA 22203-1714

(703) 526-4170
Home Page http://www.darpa.mil

STTR proposals submitted to DARPA will be processed by DARPA OASB and distributed to the appropriate technical office for evaluation and action.

DARPA selects proposals for funding based on technical merit and the evaluation criteria contained in this solicitation document. DARPA gives evaluation criterion a., The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution." (refer to section 4.2 Evaluation Criteria - Phase I - page 7), twice the weight of the other two evaluation criteria. As funding is limited, DARPA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and highly relevant to the DARPA mission. As a result, DARPA may fund more than one proposal in a specific topic area if the technical quality of the proposal(s) is deemed superior, or it may fund no proposals in a topic area. Each proposal submitted to DARPA must have a topic number and must be responsive to only one topic.

In order to ensure an expeditious award, cost proposals will be considered to be binding for a period of 180 days from the closing date of this solicitation. For contractual purposes, proposals submitted to DARPA should include a statement of work which does not contain proprietary information. Successful offerors will be expected to begin work no later than 30 days after contract award. For planning purposes, the contract award process is normally completed within 30 to 60 days from issuance of the selection notification letter to Phase I offerors.

On a pilot basis, the DoD STTR program has implemented a streamlined Fast Track process for STTR projects that attract matching cash from an outside investor for the Phase II STTR effort, as well as for the interim effort between Phases I and II. Refer to Section 4.5 for Fast Track instructions. DARPA encourages Fast Track Applications to be submitted during the last two months of the Phase I effort. Technical dialogue with DARPA Program Managers is encouraged to ensure research continuity during the interim period and Phase II. If a Phase II contract is awarded under the Fast Track program, the amount of the interim funding will be deducted from the Phase II award amount. It is expected that interim funding will not exceed $40,000.

DARPA FY 1998 Phase I STTR
Checklist

1) Proposal Format

   a. Cover Sheet - Appendix A (identify topic number) _____

   b. Project Summary - Appendix B _____

   c. Identification and Significance of Problem or Opportunity _____

   d. Phase I Technical Objectives _____

   e. Phase I Work Plan _____

   f. Related Work _____

   g. Relationship with Future Research and/or Development _____

   h. Potential Post Applications _____

   i. Key Personnel _____

   j. Facilities/Equipment _____

   k. Subcontractors/Consultants _____

   l. Prior, Current, or Pending Support of Similar Proposals or Award _____

   m. Cost Proposal (see Appendix C of this Solicitation) _____

   n. Company Commercialization Report (see Appendix E of this Solicitation) _____

   o. Agreement between the Small Business and Research Institution _____

2) Bindings

   a. Staple proposals in upper left-hand corner. _____

   b. **Do not** use a cover. _____

   c. **Do not** use special bindings. _____

3) Page Limitation

   a. Total for each proposal is 25 pages inclusive of cost proposal and resumes. _____

   b. Beyond the 25 page limit do not send appendices, attachments and/or additional references. _____

4) Submission Requirement for Each Proposal

   a. Original proposal, including signed Appendices A and B. _____

   b. Four photocopies of original proposal, including signed Appendices A and B. _____

INDEX OF DARPA FY 1998 STTR TOPICS

SUBJECT/WORD INDEX TO THE DARPA FY 1998 STTR TOPICS

DARPA FY1998 STTR TOPIC DESCRIPTIONS

DARPA ST98-001 TITLE: Biologically-Grounded Nonlinear Optical Pulse Generator

CRITICAL TECHNOLOGIES AREA: Electronics

OBJECTIVE: Develop optical microsystems for biologically-based pulse generators using nonlinear optical materials, with the overall goal of low-cost, lightweight, high density kernel-based parallel computational systems.

DESCRIPTION: The biological neuronal systems' computational capability is in part due to its use of massively parallel kernel-based processing algorithms. These can be simulated on digital machines and shown to be very powerful and versatile algorithms. However, the simulations are very slow and in many cases it is impractical to fully incorporate the full algorithms. Although the biologically-based algorithms are very effective, they are of limited use because there is no "hardware" for them. Electronic implementations invariably encounter the interconnect problem (too many wires) while standard optical implementations can handle the interconnects and even the adaptation, but must rely on electronics for signal generation and detection. The objective here is to take advantage of basic nonlinear optical effects and build an all-optical pulse generator. The baseline generator is the integrate-and-fire model. It requires a first-order relaxation effect and then a fixed threshold followed by a fast discharge. These correspond, for example, to incoherent phospher excitation or perhaps photorefractive induction, an optically bistable gate for the threshold, and multilevel nonradiative decay modes for the discharge.

PHASE I: Determine candidate linear, nonlinear, coherent, and/or incoherent optical effects corresponding to a biologically-grounded pulse generator system, with the constraint that the pulse effect be primarily a composite optical material effect. Fabricate proof-of-principle discrete pulse generators and evaluate their performance. Deliver all designs, analyses, and the pulse generators.

PHASE II: Design and build a high density, spatially continuous, optical pulse generator slab of at least 106 equivalent pixels. All work products of Phase II are deliverables.

PHASE III DUAL USE APPLICATIONS: This will provide an entirely new information processing platform based on biological neuronal systems, not only in the algorithmic approach, but in the underlying physical implementation. It will have applications in automatic object recognition, speech generation and recognition, and in adaptive control systems.

REFERENCES:

"Pulse-Coupled Neural Nets: Translation, Rotation, Scale, and Intensity Signal Invariances for Images," John L. Johnson, published in Applied Optics, Vol. 33, 6239 (1994).

DARPA ST98-002 TITLE: Optical Frequency Conversion for Efficient Blue Light Sources

CRITICAL TECHNOLOGIES AREA: Electronics

OBJECTIVE: The objective of this task is to develop new, non-traditional methods for harmonic generation of blue laser light in nonlinear materials. Proposals are sought on methods other than the conventional techniques of optical frequency conversion using angle tuning of a bulk crystal for phase matching or periodic poling to achieve quasi-phase matching.

DESCRIPTION: Efficient generation of blue laser light has important applications ranging from optical data storage to submarine communication links. For example, the data storage capacity of commercial CD-ROM's would quadruple if the wavelength of the laser diode could be reduced by a factor of two. Although research in the field of second harmonic generation has been active since the advent of the laser, efficient and robust frequency up-conversion units for low-power laser diodes are not available. A review of the field of nonlinear optical frequency conversion was recently published in Physics Today (See References).

The task is to develop novel methods of frequency up-conversion for generation of blue laser light. Device modeling and prototype development should use currently available nonlinear materials which have long term stability. The frequency up-conversion devices should occupy a small volume and be compatible with packaging requirements found in laser diodes.

PHASE I: Demonstrate the fundamental technologies required to produce efficient, robust frequency conversion devices using currently available nonlinear materials.

PHASE II: Develop efficient, robust frequency conversion devices which are compatible with laser diode packaging requirements.

PHASE III: Package a device array of blue light sources capable of high output power.

DUAL USE APPLICATIONS: Both military and civilian organizations have a need for more compact information storage. One military application is in field manuals for equipment, system drawings, and items of supply. Increased capacity for CD-ROM storage means fewer disks must be stored and protected, larger files can be placed on disk, and more video and audio information can be included in maintenance manuals (electronic version). A second use is for underwater communications: Since blue-green lasers can penetrate sea water for some distance, these devices could be utilized for covert underwater communications between seal teams or other entities. Ultimately, if higher power versions can be developed, this technology supports communications with the submarine fleet. The same advantages accrue to civilian applications. Without major changes in formatting or other expensive development, the capacity of disks can be increased. Longer programs can be placed on single disks or alternatively, the disk can be made smaller for the same information. The devices will also find application in multi-colored displays.

REFERENCES:
1) M.M. Fejer, Physics Today, May issue, p.25 (1994).

DARPA ST98-003 TITLE: Neutralization/Decontamination of Biological Warfare (BW) Pathogens

CRITICAL TECHNOLOGIES AREA: Chemical and Biological Defense

DESCRIPTION: The decontamination of personnel (including surface decontamination of skin and clothing of individuals who may have been exposed to agents), environmental areas, equipment, and facilities that have been exposed to biological warfare agents remains an essential concern. The capability to neutralize agents during an attack is also desirable. Current approaches for neutralization/decontamination utilize corrosive chemicals or require large energy sources, hence, they are not suitable for field applications where low-power consumption, portability, and compatibility with materials are essential. Current decontaminating solutions are often corrosive or toxic and require a large amount of water or other solvents, which are difficult to transport; may not always be readily available in the necessary quantities; and may generate large quantities of effluent.

DARPA seeks innovative concepts for neutralization of BW agents and decontamination of surfaces or personnel. Suitable technologies must be effective against a wide variety of agents; eliminate all detectable agent on the treated areas or surfaces; have low-power requirements; be compatible with skin, tissue surfaces, and equipment; and (if fluid based) use minimal amounts of liquid with little or no effluent.

PHASE I: Identify a suitable technology and determine the feasibility of the chosen approach with preliminary demonstration of efficacy against one or more model pathogens.

PHASE II: Demonstrate feasibility and safety in a model system with several appropriate pathogens of different classes.

PHASE III DUAL USE APPLICATIONS: The ability to decontaminate an area, to eliminate pathogens in the environment, or to sterilize a body surface would have a variety of important uses in both military and civilian medicine, as well as in agriculture. For example, the technology could be used to maintain sterile environments in hospitals and clinics, and to set up sterile surgical areas under field conditions. The potential uses for this technology will increase as pathogens in hospitals become increasingly resistant to widely used disinfectants and antimicrobial agents.

DARPA ST98-004 TITLE: Microrover Technologies for Tactical Land Warfare

CRITICAL TECHNOLOGIES AREA: Surface/Under Surface Vehicles/Ground Vehicles

DESCRIPTION: DARPA is seeking the design, development, and evaluation of microrover technologies that will enable unique and unprecedented abilities to conduct tactical warfighting operations. It is expected, but not required, that the novel warfighting abilities will be derived from the small size of the microrover, for example, by enabling it to reach destinations or perform tasks not otherwise possible. General areas of interest include innovative mobility systems and innovative on-board control systems. For the purposes of this solicitation, a microrover measures no more than 100 cm on any side.

Specific areas of interest include (but are not limited to) the following: a) Mobility systems capable of land travel, including surface, buildings, and the ability to be air-dropped; b) Mobility systems capable of travel in sewers and utility tunnels; c) On-board sensing and perception for the purposes of avoiding obstacles and seeking goals. All sensing modalities meeting microrover power and size constraints will be of interest, including (but not limited to) machine vision, machine audition, radar, and ladar. All perceptual interpretation approaches consistent with microrover computational resources will be of interest.

Specific areas of limited interest include (but are not limited to) the following: a) Mobility systems based on existing designs and approaches, when such systems do not contain substantially innovative technology; b) Algorithms for planning trajectories, paths, or routes, when such algorithms are not integrated into a microrover system; c) Algorithms for task-level

control, learning, or higher-level reasoning, when such algorithms are not integrated into a microrover system; d) Algorithms for collaboration and cooperation between multiple microrovers.

PHASE I: Develop and demonstrate mobility and on-board control system breadboards.

PHASE II: Develop, demonstrate, and deliver mobility and on-board control system brassboards. Conduct tests to quantify performance. Deliver complete documentation of test procedures, cases, and results.

PHASE III DUAL USE APPLICATIONS: Environmental cleanup, disaster relief, search and rescue, law enforcement, and drug interdiction.

DARPA ST98-005 TITLE: Micro Air Vehicle (MAV) Guidance and Navigation

CRITICAL TECHNOLOGIES AREA: Microrobotics

OBJECTIVE: Develop and demonstrate innovative guidance and navigation systems for Micro Aerial Vehicles (MAVs) which utilize on-board processing, memory, communication, and sensing capabilities of MAV systems in combination with ground station capabilities. Concepts should address maneuvering of MAVs in complex environments such as urban canyons and interior spaces where collision avoidance with objects and barriers will require use of sensor feedback and innovative, intelligent control approaches. Navigation systems will require position determination technology such as multiple transmitter/receiver triangulation, micro-miniaturized inertial navigation systems, micro-GPS, or other.

DESCRIPTION: MAV's will be at least an order of magnitude smaller than current flying systems (less than 15 cm in length, width or height) and will serve as six degree-of-freedom sensor platforms providing unprecedented situational awareness to the individual soldier in the field. Potential military missions for MAV's include surveillance and reconnaissance over diverse terrain, including such confined areas as urban canyons and interior spaces. It may be assumed for this study that the MAV has a robust flight vehicle stability and control system.

To facilitate MAV operation in combat, it is desirable to have control of the MAV at a level where one directs its placement with simple instructions. This requires the ability to determine location (navigation), and the ability to follow a path to move the MAV from current location to desired location (guidance) with a user friendly interface. The guidance must also consider feedback from sensors to perform collision avoidance maneuvers while trying to reach a waypoint or objective. Algorithms or agents are necessary to transform these simple commands into MAV guidance and navigation functions. Additionally, the guidance and navigation functions can be allocated to MAV on-board processing and ground station interface systems. However, the architecture should be sufficiently robust to tolerate MAV communication black-outs, interruptions and/or MAV control hand-offs to other ground stations. Operations in confined spaces of urban environments and building interiors requires the system to integrate ultrasonic, imaging, or other advanced sensor techniques that supply local situational information to the navigation and guidance components.

PHASE I: Develop guidance and/or navigation strategies and distributed processing architectures for vehicle and ground processing functions. Develop a software architecture evolutionary path for function allocation of guidance and navigation components between the MAV and ground station processors. Develop the preliminary guidance and or navigation system design, including sensors. Identify key attributes of system design following the estimates of the architecture evolutionary path, including navigation system accuracy capabilities and sensitivities, collision avoidance sensor requirements, guidance performance metrics, MAV and ground station on-board processing, memory, and communication requirements. Identify anticipated system trade-off issues and describe expected system performance characteristics. Identify high-risk elements of the proposed design.

PHASE II: Define guidance and/or navigation system features, including processors, software components, and external system interface requirements. Develop final design; fabricate; test; and demonstrate operation of the proposed system(s). An aerial demonstration with a suitable small vehicle (which may exceed 15 cm for purposes of demonstrating guidance and navigation functions) is desirable, but not essential. Conduct post-demonstration analysis sufficient to indicate performance of the proposed system and its suitability for integration into full MAV systems.

PHASE III DUAL USE APPLICATIONS: The development of MAV guidance and navigation systems will be useful in commercial surveillance systems. MAVs have high potential for applications in crime prevention, security systems, drug interdiction, bio-chemical hazard detection, and reconnaissance wherever conditions may be hazardous to personnel.

DARPA ST98-006 TITLE: Low-Cost, Miniature, Unattended Magnetic and Chemical Sensors Systems

CRITICAL TECHNOLOGIES AREA: Sensor Systems

OBJECTIVE: Develop and demonstrate novel concepts for detecting, localizing, and classifying targets with arrays of low-cost, miniature, internetted, unattended magnetic ground and littoral sensor systems.

DESCRIPTION: Research and development leading to the design and demonstration of novel, advanced, unattended magnetic and chemical sensor systems for the detection, localization, and classification of ground and shallow water time critical targets are required. Efforts may address individual miniature magnetic and chemical sensor systems, however, multi-sensor magnetic and chemical systems with local signal processing, data fusion, and an internetted communications capability, are also of interest. Low-power, autonomous wake-up and commanded wake-up capabilities for these unattended magnetic and chemical systems are required. Efforts of interest also include low-power, extended life, high resolution, efficient real-time feature based classifiers; models for real-time transformation of sparse sensed magnetic dipole data to predictions of threat vehicle or threat human related parameters; and decision aids to enable optimum configuration and processing of data from magnetic sensor arrays. Parameters of interest that will be utilized to evaluate proposed magnetic and chemical sensor concepts are projected cost; size; weight; reconfigurability through modular design; power consumption; covert operations; and detection, localization and classification performance. Aggregate metrics, such as dollars-per-kilometer-squared detection coverage-hours of life without battery change, will be utilized to compare proposed concepts.

PHASE I: Develop concept description and initial design of a magnetic and chemical sensor related system with clear description and quantification of key predicted performance parameters. A sensitivity analysis that indicates the predicted performance of alternate proposed system configurations, including identification of highest risk aspects of the proposed design, is also required. Risk mitigation demonstrations and/or simulations of key high risk aspects of the proposed design, to demonstrate proof-of-concept, is also required.

PHASE II: Final design and demonstration of the proposed magnetic and chemical sensor related system, with post-demonstration analysis sufficient to demonstrate proof-of-performance for the proposed system is required. Complete design and demonstration documentation must be delivered.

PHASE III DUAL USE APPLICATIONS: The development of a low-cost, high-performance, modular, miniature sensor will expand the commercial markets for home and industrial security systems, industrial process monitoring systems, and environmental monitoring systems. Increased performance; component modularity for optimum domain specific tailoring of sensor configurations; and the dramatic reduction in size, weight, and cost of these sensor systems will increase the range of potential applications for these products.

REFERENCES:
Internetted Unattended Ground Sensor System Description Document, 1995.

DARPA ST98-007 TITLE: Universal, Windows Based, High Speed Data Acquisition and Control Graphical User Interface System

CRITICAL TECHNOLOGIES AREA: Computing and Software

OBJECTIVE: To take full advantage of state-of-the-art, high speed data acquisition and control hardware by developing a Windows based, modular, universal, high speed, multi-channel data acquisition and control graphical user interface (GUI).

DESCRIPTION: High speed, long duration, and multi-channel data acquisition and control systems require the use of custom coded, DOS based programming. Recently, there has been an industry-wide push toward creating universal hardware components that conform to a VXI bus standard. This universality enables the data acquisition user to configure boards from many different vendors into a complete, comprehensive data acquisition and control system. Unfortunately, the software that is used for control of this hardware, if Windows based, is relatively slow and machine overhead intensive. Therefore, many programmers are forced to write custom code to control these VXI devices to perform highly complex tasks. This task is both time consuming and unproductive, as this custom code is generally very specific and can only be used for a specific task.

The goal of this topic is to produce a generic, windows based data acquisition and control graphical user interface and hardware system that is capable of multi-channel, high speed data acquisition with real-time display of processes and variables. The system should be capable of at least 100 channels of data at up to 1000 samples of data per channel, per second, for at least ten minutes. A comprehensive control system should be able to control up to 50 processes in either open or closed loop, with a finite, measurable control loop speed that is less than 10% of the data acquisition sample rate. The software system would be a 32 bit Windows based system, with either numerical or graphical depictions of the data values and control processes. The control equations and algorithms would have to be user modifiable.

Phase I: Demonstrate a basic, integrated graphical user interface consisting of both hardware and software with all modules active, including data acquisition, control, real-time display, graphical user interface, and software capable calibration of amplifiers. Although the Phase I system will not include all of the hardware or software to drive all of the channels, it should be capable of a significant and demonstrable portion of the overall effort, and should run at rated speed. Hardware deliverables at the conclusion of Phase I would include a VXI bus system of at least 25 data channels and 10 control channels. Software deliverables would include a working Windows based Graphical User Interface with customizable A/D and D/A modules. The software would demonstrate accuracy of process control, control loop speed, data acquisition with mass storage capability, basic data reduction, and reporting.

PHASE II: Demonstrate and deliver a fully operational GUI and VXI bus that demonstrates full capability of at least 100 channels of data at 1000 samples/sec, with a control loop speed less than 10% of the data acquisition sample rate. The system should have a fully customizable interface with absolute crash protection. Self checks in the software would make the misconfiguration of the software impossible. The software would have a self diagnostic module which would check all of the hardware components of the system. The hardware deliverables would include a full up VXI chassis, with all of the hardware channels active, and capable of full speed operation. The software should be capable of automatic calibration of A/D channels, including pressure, temperature, and strain. The graphical interface would allow seamless navigation from acquisition, control, data reduction, calibration, and reporting software modules.

PHASE III DUAL USE APPLICATIONS: A truly universal, modular, high speed data acquisition and control system has a tremendous amount of commercial application. Computer control is used in every major commercial manufacturing, testing, and evaluation industry. The system could be used to control any mechanically regulated device - from freezers to fire alarms to building security systems. Automobile manufacturers could use the GUI for assembly line process control and quality assurance programs.

REFERENCES:

1) "1996 Instrumentation Reference," National Instruments, Austin, Tx. 1996.
2) "1997 Test Systems Handbook," Hewlett Packard, Santa Clara, Ca. 1997.

BALLISTIC MISSILE DEFENSE ORGANIZATION (BMDO)
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM
Submitting Proposals - 1998 Instructions

Send Phase I proposal packages (the unbound original, to make extra copies, and six bound copies, to immediately forward to evaluators, of the full proposal, PLUS one additional copy of Appendices A and B only) by US mail (or any commercial delivery service). Also, APPENDIX E needs only to be included with the unbound original. DO NOT attach APPENDIX E to the six bound copies. The mailing address follows and the BMDO SBIR website address is provided.

Ballistic Missile Defense Organization
ATTN: TOI/SBIR(BOND)
1725 Jefferson Davis Highway, Suite 809
Arlington, VA 22202

For Administrative HELP ONLY call: 800-937-3150 or 800-WIN-BMDO
Internet Access: www.futron.com/bmdo/sbir.html

Proposals delivered by other means will not be accepted. Proposals received after the closing date will not be processed. BMDO will acknowledge receipt of proposals IF AND ONLY IF the proposal includes a self-addressed stamped envelope and a form that needs only a signature by BMDO.

All proposal submission appendices may be downloaded from the DoD SBIR/STTR Website at (http://www.acq.osd.mil/sadbu/sbir/sttrappx.htm). Furthermore, all companies are strongly encouraged to upload their APPENDIX A and APPENDIX B only, through the BMDO SBIR/STTR Website at (http://www.futron.com/bmdo/sbir.html). Uploading the two appendices will allow BMDO to process proposals faster so that evaluations can be received quickly. It is in a companies best interest to upload their APPENDIX A and APPENDIX B since those proposals will be processed first.

BMDO is working toward providing a ballistic missile defense system and developing a technology base that will allow the Department of Defense to protect the warfighters against increasingly sophisticated and lethal missiles around the world. BMDO accomplishes these efforts through three broad mission focus areas: Theater Missile Defense (TMD), National Missile Defense (NMD), and Advanced Technology Developments (ATD).

TMD systems respond to and protect U.S. forces, allies, and other countries from existing and emerging short to medium range threat missiles. Three core programs represent the bulk of BMDO investments: PATRIOT Advanced Capability-3 (PAC-3), Navy Area Defense, and Theater High-Altitude Area Defense System (THAAD). NMD is concerned with the possibility of a limited ballistic missile strike against the homeland. The key component systems currently under consideration include: ground-based interceptors; ground-based radars; upgraded early-warning radars; battle management, command, control, and communications (BMC3); and advanced sensor technology developments. Finally, BMDO depends on advanced technology developments, of all aspects, to invigorate its ability to implement both TMD and NMD systems in response to increasingly sophisticated ballistic missile threats, to include cruise missiles. Therefore, the continued availability of such advanced technology developments has become an increasingly vital and critical element of the overall BMDO mission.

The intent of BMDO, first and foremost, is to seek out the most innovative technology that might enable a defense against a missile in flight -- lighter, faster, stronger, more reliable technologies are all of interest. Proposing companies need not know specific details or requirements of possible BMDO systems, research and development goals, or specific technology needs or specifications, but must understand that potential technologies should have application to ballistic missile defense at some level. (A better fire extinguisher, although it may be innovative and there is a commercial market, does not support ballistic missile defense requirements at any level.)

Specifically, BMDO seeks to invest seed-capital, which supplements private sector investment support, in a product with a future market potential (preferably private sector) and a measurable BMDO benefit. The BMDO SBIR/STTR Program will neither support nor further develop concepts already mature enough to compete for private capital or for mainline government research and development funds. BMDO prefers projects which move technology from the non-profit institution into the private sector market through a market-oriented small company. Phase I proposals should focus on the innovation of the proposed technology, it should illustrate the concept

feasibility, and the merit of a Phase II for a prototype or at the very least a proof-of-concept. Phase II competition will also be judged intensely on future market possibilities and commercialization potential. Phase II proposals may be submitted to BMDO anytime, for any amount, in any format after the Phase I begins. Unique efforts showing time sensitivity or submitted for FasTrack will be given due consideration for Phase II start-up funding and Phase I proposals may include a post-Phase I optional tasking that will permit rapid start-up if the Phase II or FasTrack application is approved. The latest information on how BMDO implements its FasTrack Program may be found at the website address under the Frequently Asked Questions (FAQs) section.

Principal Investigators who are tenured faculty are NOT considered primarily employed by a small firm if they receive compensation from the university while performing the SBIR or STTR contract; any waiver must be requested explicitly with a justification showing a compelling rational and national need; BMDO expects to grant no such waivers.

BMDO intends for a Phase I to be only an examination of the merit of the concept or technology with an average cost under $65,000. Although proposed cost will not affect selection for negotiation, contracting may be delayed if BMDO reduces the proposed cost. DO NOT submit the same proposal, or variations thereof, to more than one BMDO topic area; each idea will be judged once in an open competition among all proposals. Furthermore, BMDO performs numerous cross-reference checks within each solicitation.

Because BMDO seeks the best nation-wide experts in innovative technology, proposing comapnies may suggest technical government reviewers by enclosing a cover letter with the name, organization, address, phone number, and rationale for each suggestion. BMDO promises only to consider the suggestion and reserves the right to solicit other evaluations.

Ballistic Missile Defense Organization 1998 STTR Topics

BMDO98T-001 - Sensors

BMDO98T-002 - Electronics and Photonics

BMDO98T-003 - Surprises and Opportunities

BMDO FY98 STTR TOPIC DESCRIPTIONS

BMDO 98T-001 TITLE: SENSORS

Introduction: BMDO investigates various sensor technologies for both TMD and NMD applications. As such, a significant investment is made each year in the continued development of increasingly robust and sophisticated sensor systems which may eventually find their utilization in a ballistic missile acquisition system. All areas of the electromagnetic spectrum provide potential avenues toward finding and disabling a ballistic missile in flight. Furthermore, sensor systems, components, sub-components, and piece part specifics are constantly under evaluation by the various TMD and NMD elements for replacement by the latest technology developments from industry.

Description: Sensors and their associated systems/sub-systems will function as the "eyes and ears" for ballistic missile defense applications, providing early warning of attack, target detection/classification/identification, target tracking, and kill determination. New and innovative approaches to these requirements using unconventional and innovative techniques are encouraged across a broad band of the electromagnetic spectrum, from radar to gamma-rays. Passive, active, and interactive techniques for discriminating targets from backgrounds, debris, decoys and other penetration aids are specifically sought. Sensor-related device technology is also needed. Examples of some of the technology specific areas are: cryogenic coolers (open and closed systems), cryogenic heat transfer, superconducting focal plane detector arrays (for both the IR and sub-mm spectral regions), signal and data processing algorithms (for both conventional focal plane and interferometric imaging systems), low-power optical and sub-mm wave beam steering, range-doppler lidar and radar, passive focal plane imaging (long-wavelength infrared to ultra-violet; novel information processing to maximize resolution while minimizing detector element densities), interferometry (both passive and with active illumination), gamma-ray detection, neutron detection, intermediate power frequency agile lasers for diffractive beam steering and remote laser induced emission spectroscopy, lightweight compact efficient fixed frequency radiation sources for space-based ballistic missile defense applications (uv-sub-mm wave), new optics and optical materials. Entirely new and high-risk approaches are also sought.

Successful Phase 3/Dual-Use Commercializers (Real-World Examples): Company G, with commercial sales of $15M+, is noted for its laser diode pumped q-switched solid state laser products. Company H, with a market cap of $24M+, transferred its microwave based infrared detector and superconducting millimeter wave mixer technologies for a variety of cryogenic systems and products. Company I's high power laser array transmitters are utilized on future military satellites for communications.

BMDO 98T-002 TITLE: ELECTRONICS AND PHOTONICS

Introduction: In implementing its TMD and NMD program activities, BMDO is continuing its developments of such efforts as the PATRIOT Advanced Capability-3 (PAC-3) missile system which has four major systems components: radar, engagement control station, launching station, and interceptors. The Navy Area Wide system will develop a sea-based capability that builds upon the existing AEGIS/Standard Missile air defense system. This system is based on the AEGIS-class cruisers and destroyers, which provide all elements of missile defense and are particularly suited to protecting forces moving inland from the sea. The Theater High-Altitude Area Defense System (THAAD) system will form the largest umbrella of missile protection in a specific theater, arching over all other missile defense systems. THAAD consists of four major systems components: truck-mounted launchers; interceptors; radar system; and battle management, command, control, communications, and intelligence (BMC3I). These increasingly sophisticated systems will provide the opportunity to destroy short and medium range ballistic missiles and other threats in the atmosphere far enough away that falling debris will not endanger friendly forces..

Description: The necessary advances in electronics for the many ballistic missile defense applications will require advances in electronics materials. Primary emphasis lies in advancing the capability of integrated circuits, detectors, sensors, large scale integration, radiation hardness, and all electronic components. Novel quantum-well/superlattice structures which allow the realization of unique elective properties through "band gap engineering" are sought as are new organic and polymer materials with unique electronic characteristics. In addition, exploitation of the unusual electronic properties of gallium nitride is of considerable interest. Among the many BMDO electronic needs and interest are advances in high frequency transistor structures, solid state lasers, optical detectors, low dielectric constant packaging materials, tailored thermal conductivity, microstructural waveguides, multilayer capacitors, single-electron transistors, metallization methods for repair of conducting paths in polyceramic systems, and sol-gel processing for packaging materials.

Also, dense computing capability is sought in all architectural variations, from all optic to hybrid computers. Specific examples of areas to be addressed include, but are not limited to: high speed multiplexing, monolithic optoelectronic transmitters, holographic methods, reconfigurable interconnects, optoelectronic circuits, and any other technology contributing to advances in intra-computer communications, optical logic gates, bistable memories, optical transistors, and power limiters. Non-linear optical materials advancements and new bistable optical device configurations are of interest.

Successful Phase 3/Dual-Use Commercializers (Real-World Examples): Company Y, with a market cap of $210M+, commercialized technology that allowed for the delivery of ultra-pure materials to semiconductor thin film reactors.

Company Z, with a market cap of $14M+, manufactures radiation detection devices and was funded for avalanche photodiode arrays. Company AA, with a market cap of $97M+, has a substantial market share of the atomic layer epitaxy growth method of semiconductor compound materials based on efforts funded under this topic. Company BB, with a market cap of $155M+, which manufactures flat panel display devices, received some initial funding for their silicon-on-insulator films and organometallic chemical vapor deposition technology developments. Company CC, with a market cap of $200M+, commercialized technology based on degradation resistant laser diodes. Company DD, with a market cap of $14M+, is in the process of commercializing technology based on its surge suppression devices. Company EE, with a market cap of $265M+, had initial funding for its high bandgap compounds and laser diode products to develop a number of commercial and military products. Company KK established a multilayer coating technology that can be easily transported to any location for application. Company FF developed a magnetoresistive non-volatile random access memory chip which is also radiation hardened and is utilized in a number of space applications for the military and commercial sectors. Company R took a unique technology approach in addressing fiber-optic and other optical communications applications to both the military and commercial industry. Company S is providing a low-loss electro-optical switching array, Company T is providing optical bus extenders and fiber-optic modulators, Company U has funded technology which utilized wavelength division multiplexing techniques; all to support the ever growing optical communication industry.

BMDO 98T-003 **TITLE : SURPRISES AND OPPORTUNITIES**

Introduction: BMDO increasingly depends on advanced technology developments, of all kinds, to invigorate its ability to find and disable missiles in flight and to defend against an increasingly sophisticated threat, to include cruise missiles. Therefore, the continued availability of emerging technology has become a vital part of its mission. BMDO has specific programs which pursue speculative, high-risk technologies that could spur a revolutionary leap in ballistic missile defense capability. Specific goals include, but are not limited to: quickening the pace of technology and innovation developments and decreasing the time required to transform scientific breakthroughs into actual applications.

Description: Since ballistic missile defense is an exploration at technology's leading edge to begin with, it recognizes that surprises and opportunities may arise from creative and innovative minds. BMDO will consider proposals in other technologies where they present a completely unique and unusual opportunity for ballistic missile defense applications. The proposing company should take special care to describe the specific technology in complete detail and specify why ballistic missile defense applications would benefit from exploring its unique and novel implications. Proposing companies should make special note that proposals in this topic will receive preliminary screening at BMDO and that they may be rejected as too far afield without the benefit of a full technical review received by proposals in the topics already listed. It is recommended that the proposing company focuses their submission toward one of the specific outlined topics above unless the technology proposed is truly an unquestionable innovation. This full and open call is for new/novel/innovative/unique advanced technology developments, and not for the recycling of old ideas, incremental advancements, or questionable improvements.

Successful Phase 3/Dual-Use Commercializers (Real-World Examples): Company JJ, with a market cap of $740M+ (The largest of any BMDO SBIR/STTR recipient.), was funded for technology to further its intelligent client-server software solutions for mission-critical decision applications in real-time military and commercial environments.

Any potential new development may address a DoD Critical Technology Area from this topic, provided it supports BMDO mission interest at some level. DoD Key Technology Areas:

#1 - Aerospace Propulsion and Power
#2 - Air Vehicles/Space Vehicles
#3 - Battlespace Environments
#7 - Command, Control and Communications
#8 - Computing and Software
#9 - Conventional Weapons
#10-Electronics
#11-Electronic Warfare/Directed Energy Weapons
#13-Human Systems Interface
#14-Manpower, Personnel and Training
#15-Materials, Processes and Structures
#16-Sensors
#17-Surface/Under Surface/Ground Vehicles
#18-Manufacturing Sciences and Technology
#19-Modeling and Simulation

9.0 SUBMISSION FORMS AND CERTIFICATIONS

Section 9.0 contains:

Appendix A: **Proposal Cover Sheet**
Appendix A must be included with each proposal submitted.

Appendix B: **Project Summary Form**
Appendix B must be included with each proposal submitted. Don't include proprietary or classified information in the project summary form.

Appendix C: **Cost Proposal Outline**
A cost proposal following the format in Appendix C must be included with each proposal submitted.

Appendix D: **Fast Track Application Form**
A DoD pilot program under which projects that attract outside investors receive interim funding and selection for Phase II award provided they are "technically sufficient" and have substantially met Phase I goals.

Appendix E: **Company Commercialization Report**
A report that identifies each Phase II SBIR and/or STTR project your firm has received. All Phase I and Phase II proposals must include a Company Commercialization Report.

Reference A: **Model Agreement for the Allocation of Intellectual Property and Follow-on Rights**
This is only a model provided as a guideline for the small business in the development of an agreement that allocates intellectual property rights and rights to follow-on research, development, or commercialization between the small business and the research institution (see Section 3.4.o for more details). The small business is not required to use this model agreement, in whole or part, for its agreement with the research institution. A written agreement between the small business and research institution need not be submitted with the proposal, but must be available upon request.

Reference B: **Proposal Receipt Notification Form**

Reference C: **Directory of Small Business Specialists**

Reference D: **SF 298 Report Documentation Page**

Reference E: **DoD Fast Track Guidance**

Reference F: **List of Eligible FFRDCs**

Reference G: **DoD SBIR/STTR Mailing List Form**

U.S. DEPARTMENT OF DEFENSE
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
PROPOSAL COVER SHEET

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

TOPIC NUMBER:	PROPOSAL TITLE:	
PRINCIPAL INVESTIGATOR:		PI TELEPHONE:
PROPOSED COST:	PHASE I OR II:	PROPOSED DURATION IN MONTHS:

FIRM	RESEARCH INSTITUTION
NAME:	NAME:
STREET:	STREET:
CITY: STATE: ZIP:	CITY: STATE: ZIP:
CORPORATE OFFICIAL NAME:	INSTITUTE OFFICIAL NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
PERCENTAGE OF WORK: (minimum of 40%)	PERCENTAGE OF WORK: (minimum of 30%)

CERTIFICATION:

	YES	NO
Is the FIRM a small business as described in section 2.3?	☐	☐
Is the INSTITUTION a research institution as defined in section 2.4?	☐	☐
Is the FIRM a socially and economically disadvantaged business as defined in section 2.5? (Collected for statistical purposes only)	☐	☐
Is the FIRM a woman-owned small business as described in section 2.6? (Collected for statistical purposes only)	☐	☐
Number of employees in the FIRM including all affiliates:	_____	
Has this proposal has been submitted to other government agencies or DoD components? If yes, list the names of the agency or component and topic number below:	☐	☐

For any purpose other than to evaluate the proposal, this data except Appendix A and B shall not be disclosed outside the Government and shall not be duplicated, used or disclosed in whole or in part, provided that if a contract is awarded to this proposer as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained on the pages of the proposal listed on the line below.

PROPRIETARY INFORMATION: _____

Before signing below, please read the cautionary note at Section 3.7.

SIGNATURE OF PRINCIPAL INVESTIGATOR DATE	SIGNATURE OF CORPORATE OFFICIAL DATE	SIGNATURE OF INSTITUTION OFFICIAL DATE

Nothing on this page is classified or proprietary information/data

INSTRUCTIONS FOR COMPLETING APPENDIX A

AND APPENDIX B

General:

DOD Components employ automated optical devices to record STTR proposal information. Therefore the proposal cover sheet (Appendix A) and the project summary (Appendix B) should be TYPED without proportional spacing using one of the following type styles:

Courier 12,10 or 12 pitch
Courier 71 10 pitch
Elite 71
Letter Gothic 10 or 12 pitch
OCR-B 10 or 12 pitch
Pica 72 10 pitch
Prestige Elite 10 or 12 pitch
Prestige Pica 10 Pitch

Whenever a numerical value is requested type the numerical character (i.e. in "Proposed Duration" type 6 NOT six).

When typing address information use the two alphabet characters used by the Post Office for the state, DO NOT SPELL OUT THE FULL STATE NAME (i.e. type NY not New York or N.Y.).

The original proposal (with forms) plus (4) complete copies must be submitted (see Section 6).

Carefully align the forms in the typewriter using the underlines as a guide. The forms are printed to accommodate standard typewriter spacing.

Request for Copies:

Additional forms may be downloaded from our Home Page (http://www.acq.osd.mil/sadbu/sbir). They may also be obtained from your State SBIR/STTR Organization (Reference D) or:

DoD SBIR/STTR Support Services
2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

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FIRM	RESEARCH INSTITUTION
NAME:	NAME:
STREET:	STREET:
CITY: STATE: ZIP:	CITY: STATE: ZIP:
CORPORATE OFFICIAL NAME:	INSTITUTE OFFICIAL NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
PERCENTAGE OF WORK: (minimum of 40%)	PERCENTAGE OF WORK: (minimum of 30%)

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If yes, list the names of the agency or component and topic number below:

_____

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FIRM	RESEARCH INSTITUTION
NAME:	NAME:
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CITY: STATE: ZIP:	CITY: STATE: ZIP:
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PHASE I OR II PROPOSAL:	FIRM NAME:	PRINCIPAL INVESTIGATOR:

TECHNICAL ABSTRACT (Limit your abstract to 200 words with no classified or proprietary information/data)

ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT

KEYWORDS (List a maximum of 8 Keywords that describe the project)

INSTRUCTIONS FOR COMPLETING APPENDIX A

AND APPENDIX B

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TOPIC NUMBER:	PROPOSAL TITLE:	
PHASE I OR II PROPOSAL:	FIRM NAME:	PRINCIPAL INVESTIGATOR:

TECHNICAL ABSTRACT (Limit your abstract to 200 words with no classified or proprietary information/data)

ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT

KEYWORDS (List a maximum of 8 Keywords that describe the project)

Nothing on this page is classified or proprietary information/data

INSTRUCTIONS FOR COMPLETING APPENDIX A

AND APPENDIX B

General:

DOD Components employ automated optical devices to record STTR proposal information. Therefore the proposal cover sheet (Appendix A) and the project summary (Appendix B) should be TYPED without proportional spacing using one of the following type styles:

Courier 12,10 or 12 pitch
Courier 71 10 pitch
Elite 71
Letter Gothic 10 or 12 pitch
OCR-B 10 or 12 pitch
Pica 72 10 pitch
Prestige Elite 10 or 12 pitch
Prestige Pica 10 Pitch

Whenever a numerical value is requested type the numerical character (i.e. in "Proposed Duration" type 6 NOT six).

When typing address information use the two alphabet characters used by the Post Office for the state, DO NOT SPELL OUT THE FULL STATE NAME (i.e. type NY not New York or N.Y.).

The original proposal (with forms) plus (4) complete copies must be submitted (see Section 6).

Carefully align the forms in the typewriter using the underlines as a guide. The forms are printed to accommodate standard typewriter spacing.

Request for Copies:

Additional forms may be downloaded from our Home Page (http://www.acq.osd.mil/sadbu/sbir). They may also be obtained from your State SBIR/STTR Organization (Reference D) or:

DoD SBIR/STTR Support Services
2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
PROPOSAL COVER SHEET

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

TOPIC NUMBER:	PROPOSAL TITLE:	
PHASE I OR II PROPOSAL:	FIRM NAME:	PRINCIPAL INVESTIGATOR:

TECHNICAL ABSTRACT (Limit your abstract to 200 words with no classified or proprietary information/data)

ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT

KEYWORDS (List a maximum of 8 Keywords that describe the project)

Nothing on this page is classified or proprietary information/data

INSTRUCTIONS FOR COMPLETING APPENDIX A

AND APPENDIX B

General:

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U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

COST PROPOSAL

Background:

The following items, as appropriate, should be included in proposals responsive to the DoD Solicitation Brochure.

Cost Breakdown Items (in this order, as appropriate):

1. Name of offeror
2. Home office address
3. Location where work will be performed
4. Title of proposed effort
5. Topic number and topic title from DoD Solicitation Brochure
6. Total dollar amount of the proposal
7. Direct material costs
   a. Purchased parts (dollars)
   b. Subcontracted items (dollars)
   c. Other
      (1) Raw material (dollars)
      (2) Your standard commercial items (dollars)
      (3) Interdivisional transfers (at other than cost dollars)
   d. Total direct material (dollars)
8. Material overhead (rate_____%) x total direct material = dollars
9. Direct labor (specify)
   a. Type of labor, estimated hours, rate per hour and dollar cost for each type
   b. Total estimated direct labor (dollars)
10. Labor overhead
    a. Identify overhead rate, the hour base and dollar cost
    b. Total estimated labor overhead (dollars)
11. Special testing (include field work at government installations)
    a. Provide dollar cost for each item of special testing
    b. Estimated total special testing (dollars)
12. Special equipment
    a. If direct charge, specify each item and cost of each
    b. Estimated total special equipment (dollars)
13. Travel (if direct charge)
    a. Transportation (detailed breakdown and dollars)
    b. Per diem or subsistence (details and dollars)
    c. Estimated total travel (dollars)
14. Subcontracts (eg., consultants)
    a. Identify each, with purpose, and dollar rates
    b. Total estimated consultants costs (dollars)
15. Other direct costs (specify)
    a. Total estimated direct cost and overhead (dollars)
16. General and administrative expense
    a. Percentage rate applied
    b. Total estimated cost of G&A expense (dollars)
17. Royalties (specify)
    a. Estimated cost (dollars)
18. Fee or profit (dollars)
19. Total estimate cost and fee or profit (dollars)
20. The cost breakdown portion of a proposal must be signed by a responsible official, and the person signing must have typed name and title and date of signature must be indicated.
21. On the following items offeror must provide a yes or no answer to each question.
    a. Has any executive agency of the United State Government performed any review of your accounts or records in connection with any other government prime contract or subcontract within the past twelve months? If yes, provide the name and address of the reviewing office, name of the individual and telephone extension.
    b. Will you require the use of any government property in the performance of this proposal? If yes, identify.
    c. Do you require government contract financing to perform this proposed contract? If yes, then specify type as advanced payments or progress payments.
22. Type of contract proposed, either cost-plus-fixed-fee or firm-fixed price.

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FAST TRACK PROGRAM QUALIFICATIONS (see Section 4.5 of the solicitation for detailed explanation)
To qualify for the STTR Fast Track, a company must submit a Fast Track application and meet the other requirements detailed in Section 4.5 of the solicitation. This form, when completed and signed by both the company and its investor, should be included as the cover sheet of the Fast Track application. Instructions on where to submit the application are on the back of this form.

TOPIC #:	CONTRACT #:	PHASE I EFFECTIVE START DATE:	PHASE I COMPLETION DATE:
PHASE I TITLE:			
FIRM:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	
OUTSIDE INVESTOR:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	

BUSINESS CERTIFICATION:

	YES	NO
▸ Has your company ever received a Phase II SBIR or STTR award from the federal government (including DoD)? If yes, the minimum matching rate is $1 for every STTR dollar. If no, the minimum matching rate is 25 cents for every STTR dollar.	☐	☐
▸ Does the outside funding proposed in this application qualify as a "Fast Track investment", and does the investor quality as an "outside investor", as defined in DoD Fast Track Guidance (Reference E)? If you have any questions about this, call the DoD SBIR/STTR Help Desk (800-382-4634). The Help Desk will refer any policy and/or substantive questions to appropriate DoD personnel for an official response.	☐	☐

Caution: knowingly and willfully making any false, fictitious, or fraudulent statements or representations above may be felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both.

PROPOSED STTR AND MATCHING FUNDS:

- Proposed DoD STTR funds for the interim effort: $_____
- Proposed DoD STTR funds for Phase II: $_____
- Total proposed DoD STTR funds (interim + Phase II): $_____
- Amount of matching funds (cash) the investor will provide: $_____

By signing below, the parties are stating that the outside investor will provide matching funds, in the amount listed above, contingent on the company's selection for Phase II STTR award. If the matching funds are not transferred from the investor to the company within 45 days after DoD has notified the company that it has been selected for Phase II award, the company will be ineligible to compete for a Phase II award not only under the Fast track but also under the regular Phase II competition, unless a specific written exception is granted by the Component STTR program manager.

FIRM OFFICIAL	OUTSIDE INVESTOR OFFICIAL
NAME:	NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
SIGNATURE: DATE:	SIGNATURE: DATE:

Nothing on this page is classified or proprietary information/data

INSTRUCTIONS FOR COMPLETING APPENDIX D

SUBMISSION:

Submit the Fast Track application, including the three items discussed in Section 4.5(b), to the technical monitor for your Phase I project. In addition, submit a copy of the entire application to the Program Manager of the DoD Component funding the STTR project (addresses below). Finally, send a copy of this application cover sheet, when completed, to the DoD SBIR/STTR Program Manager, 3061 Defense Pentagon, Room 2A338, Washington, DC 20301-3061. Do not submit other items in the Fast Track application to the DoD STTR Program Manager.

Department of the Army
Director, Army Research Office
ATTN: AMXRO-RT (Ltc. Ken Jones)
4300 S. Miami Boulevard
Research Triangle Park, NC 27709

Department of the Navy
ONR 362 STTR
800 N. Quincy Street
Arlington, VA 22217-5660

Department of the Air Force
AFPL/XPXP, Suite 6
ATTN: R.J. Dickman
Wright Patterson AFB, OH 45433-5006

Ballistic Missile Defense Organization
ATTN: TOI/STTR (Bond)
1725 Jefferson Davis Highway
Suite 809
Arlington, VA 22202

Defense Advanced Research Projects Agency
ATTN: STTR Program Manager (Ms. C. Jacobs)
3701 N. Fairfax Drive
Arlington, VA 22203-1714

REQUEST FOR COPIES OF THIS FORM:

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Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

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PHASE I TITLE:			
FIRM:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	
OUTSIDE INVESTOR:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	

BUSINESS CERTIFICATION:

	YES	NO
▸ Has your company ever received a Phase II SBIR or STTR award from the federal government (including DoD)? If yes, the minimum matching rate is $1 for every STTR dollar. If no, the minimum matching rate is 25 cents for every STTR dollar.	☐	☐
▸ Does the outside funding proposed in this application qualify as a "Fast Track investment", and does the investor quality as an "outside investor", as defined in DoD Fast Track Guidance (Reference E)? If you have any questions about this, call the DoD SBIR/STTR Help Desk (800-382-4634). The Help Desk will refer any policy and/or substantive questions to appropriate DoD personnel for an official response.	☐	☐

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PROPOSED STTR AND MATCHING FUNDS:

- Proposed DoD STTR funds for the interim effort: $_____
- Proposed DoD STTR funds for Phase II: $_____
- Total proposed DoD STTR funds (interim + Phase II): $_____
- Amount of matching funds (cash) the investor will provide: $_____

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FIRM OFFICIAL	OUTSIDE INVESTOR OFFICIAL
NAME:	NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
SIGNATURE: DATE:	SIGNATURE: DATE:

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Department of the Army
Director, Army Research Office
ATTN: AMXRO-RT (Ltc. Ken Jones)
4300 S. Miami Boulevard
Research Triangle Park, NC 27709

Department of the Navy
ONR 362 STTR
800 N. Quincy Street
Arlington, VA 22217-5660

Department of the Air Force
AFPL/XPXP, Suite 6
ATTN: R.J. Dickman
Wright Patterson AFB, OH 45433-5006

Ballistic Missile Defense Organization
ATTN: TOI/STTR (Bond)
1725 Jefferson Davis Highway
Suite 809
Arlington, VA 22202

Defense Advanced Research Projects Agency
ATTN: STTR Program Manager (Ms. C. Jacobs)
3701 N. Fairfax Drive
Arlington, VA 22203-1714

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U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

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FIRM:		TAXPAYER ID#:	
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CITY:	STATE:	ZIP:	
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BUSINESS CERTIFICATION:

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FIRM OFFICIAL	OUTSIDE INVESTOR OFFICIAL
NAME:	NAME:
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INSTRUCTIONS FOR COMPLETING APPENDIX D

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Arlington, VA 22202

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ATTN: STTR Program Manager (Ms. C. Jacobs)
3701 N. Fairfax Drive
Arlington, VA 22203-1714

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U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFRER (STTR) PROGRAM
COMPANY COMMERCIALIZATION REPORT

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FIRM NAME: ____________________

MAIL ADDRESS: ____________________

____

CITY: ____________________ STATE: __________ ZIP: __________

- How many Phase II SBIR or STTR awards has your firm received from the Federal Government (including DoD)? (The answer "none" will not affect your ability to obtain an STTR award.) __________
- If your firm has received 5 or more Phase II SBIR and/or STTR awards from the Federal Government and the first award was received prior to Jan. 1, 1991, what percentage of your firm's revenues during your last fiscal year is Federal SBIR and/or STTR funding (Phase I and/or II)? __________
- Identify each Phase II SBIR and/or STTR project your firm has received and, for each project, provide the total revenue to date from resulting sales of new products or non-R&D services to DoD or its prime contractors, other government agencies, and private sector customers. Also provide total non-SBIR, non-STTR funding received from government and private sector sources to further develop the SBIR or STTR technology (including R&D, manufacturing, marketing, etc.). Apportion sales revenue and non-SBIR, non-STTR funding among the various Phase II projects without double-counting. (See back for further instruction.)

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

FIRM CORPORATE OFFICIAL

NAME: ____________________ TELEPHONE: ____________________

TITLE: ____________________ FAX: ____________________

Before signing below, please read the cautionary note at Section 3.7

____________________ __________

SIGNATURE OF FIRM CORPORATE OFFICIAL DATE

INSTRUCTIONS FOR COMPLETING APPENDIX E

General:

The Company Commercialization Report (Appendix E) shall NOT be counted toward proposal page count limitations.

Appendix E should be the last page(s) of your proposal.

Use as many Appendix E forms as needed to report ALL Phase II projects. (Make black and white copies of this form, if necessary.) If multiple pages are submitted, fill in the "Page___of___" in the lower right corner.

Type in either a 10 or 12 characters per inch font.

Carefully align the forms in the typewriter using the underlines as a guide.

Use the Post Office two-letter abbreviation for the state (i.e. type NY not New York).

Definitions:

Sales - sales of products or non-R&D services resulting from the technology associated with this Phase II project. Sales also includes the sale of technology or rights. Specify the sales revenue in dollars (1) to the DoD and/or DoD prime contractors, (2) to other government agencies (federal, state, local and/or foreign), and (3) to the private sector. Include sales made by your firm as well as by other firms that may have acquired the SBIR or STTR developed technology. (e.g., spin-off companies, licensees, etc.)

non-SBIR/STTR funding - non-SBIR/non-STTR government or private sector funds to further develop the technology (including R&D, manufacturing, marketing, etc.) associated with this Phase II project.

Apportion sales/funding - If two or more Phase II projects contributed to a single products or technology right that has been sold or received non-SBIR, non-STTR funding, divide proportionately the sales or funding among the contributing projects. For example, Phase II projects A and B lead to the sale of a new product "Widget" to the Army for a total of $10 million and to retail software stores for $12 million. Under the heading "DoD/Primes Sales:" put $5 million and under the heading "Private Sector Sales:" put $6 million for both Phase II projects A and B.

non-R&D Services - any services that do not include additional R&D work on the SBIR/STTR technology – for example, engineering services, study and analysis, information services.

Submission:

ALL Phase I and Phase II proposals must include a Company Commercialization Report (Appendix E). Please do not submit supplemental material.

Request for Copies:

Additional forms may be downloaded from our Home Page (http://www.acq.osd.mil/sadbu/sbir). They may also be obtained from your State SBIR/STTR Organization (Reference D) or:

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2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFRER (STTR) PROGRAM
COMPANY COMMERCIALIZATION REPORT

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FIRM NAME: ______________________________

MAIL ADDRESS: ______________________________

____

CITY: ____________________ STATE: ________ ZIP: ________

- How many Phase II SBIR or STTR awards has your firm received from the Federal Government (including DoD)? (The answer "none" will not affect your ability to obtain an STTR award.) ________
- If your firm has received 5 or more Phase II SBIR and/or STTR awards from the Federal Government and the first award was received prior to Jan. 1, 1991, what percentage of your firm's revenues during your last fiscal year is Federal SBIR and/or STTR funding (Phase I and/or II)? ________
- Identify each Phase II SBIR and/or STTR project your firm has received and, for each project, provide the total revenue to date from resulting sales of new products or non-R&D services to DoD or its prime contractors, other government agencies, and private sector customers. Also provide total non-SBIR, non-STTR funding received from government and private sector sources to further develop the SBIR or STTR technology (including R&D, manufacturing, marketing, etc.). Apportion sales revenue and non-SBIR, non-STTR funding among the various Phase II projects without double-counting. (See back for further instruction.)

Agency: ________ Topic Number: ________ Contract Number: ________

Project Title: ______________________________

DoD/Primes Sales: ________ Other Gov't Sales: ________ Private Sector Sales: ________

non-SBIR/STTR Gov't Funds: ________ non-SBIR/STTR Private Sector Funds: ________

Agency: ________ Topic Number: ________ Contract Number: ________

Project Title: ______________________________

DoD/Primes Sales: ________ Other Gov't Sales: ________ Private Sector Sales: ________

non-SBIR/STTR Gov't Funds: ________ non-SBIR/STTR Private Sector Funds: ________

Agency: ________ Topic Number: ________ Contract Number: ________

Project Title: ______________________________

DoD/Primes Sales: ________ Other Gov't Sales: ________ Private Sector Sales: ________

non-SBIR/STTR Gov't Funds: ________ non-SBIR/STTR Private Sector Funds: ________

Agency: ________ Topic Number: ________ Contract Number: ________

Project Title: ______________________________

DoD/Primes Sales: ________ Other Gov't Sales: ________ Private Sector Sales: ________

non-SBIR/STTR Gov't Funds: ________ non-SBIR/STTR Private Sector Funds: ________

Agency: ________ Topic Number: ________ Contract Number: ________

Project Title: ______________________________

DoD/Primes Sales: ________ Other Gov't Sales: ________ Private Sector Sales: ________

non-SBIR/STTR Gov't Funds: ________ non-SBIR/STTR Private Sector Funds: ________

FIRM CORPORATE OFFICIAL

NAME: ____________________ TELEPHONE: ____________________

TITLE: ____________________ FAX: ____________________

Before signing below, please read the cautionary note at Section 3.7

____________________ ________

SIGNATURE OF FIRM CORPORATE OFFICIAL DATE

INSTRUCTIONS FOR COMPLETING APPENDIX E

General:

The Company Commercialization Report (Appendix E) shall NOT be counted toward proposal page count limitations.

Appendix E should be the last page(s) of your proposal.

Use as many Appendix E forms as needed to report ALL Phase II projects. (Make black and white copies of this form, if necessary.) If multiple pages are submitted, fill in the "Page__of__" in the lower right corner.

Type in either a 10 or 12 characters per inch font.

Carefully align the forms in the typewriter using the underlines as a guide.

Use the Post Office two-letter abbreviation for the state (i.e. type NY not New York).

Definitions:

Sales - sales of products or non-R&D services resulting from the technology associated with this Phase II project. Sales also includes the sale of technology or rights. Specify the sales revenue in dollars (1) to the DoD and/or DoD prime contractors, (2) to other government agencies (federal, state, local and/or foreign), and (3) to the private sector. Include sales made by your firm as well as by other firms that may have acquired the SBIR or STTR developed technology. (e.g., spin-off companies, licensees, etc.)

non-SBIR/STTR funding - non-SBIR/non-STTR government or private sector funds to further develop the technology (including R&D, manufacturing, marketing, etc.) associated with this Phase II project.

Apportion sales/funding - If two or more Phase II projects contributed to a single products or technology right that has been sold or received non-SBIR, non-STTR funding, divide proportionately the sales or funding among the contributing projects. For example, Phase II projects A and B lead to the sale of a new product "Widget" to the Army for a total of $10 million and to retail software stores for $12 million. Under the heading "DoD/Primes Sales:" put $5 million and under the heading "Private Sector Sales:" put $6 million for both Phase II projects A and B.

non-R&D Services - any services that do not include additional R&D work on the SBIR/STTR technology – for example, engineering services, study and analysis, information services.

Submission:

ALL Phase I and Phase II proposals must include a Company Commercialization Report (Appendix E). Please do not submit supplemental material.

Request for Copies:

Additional forms may be downloaded from our Home Page (http://www.acq.osd.mil/sadbu/sbir). They may also be obtained from your State SBIR/STTR Organization (Reference D) or:

DoD SBIR/STTR Support Services
2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFRER (STTR) PROGRAM
COMPANY COMMERCIALIZATION REPORT

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FIRM NAME: ______________________________

MAIL ADDRESS: ______________________________

____

CITY: ____________________ STATE: __________ ZIP: __________

- How many Phase II SBIR or STTR awards has your firm received from the Federal Government (including DoD)? (The answer "none" will not affect your ability to obtain an STTR award.) ______
- If your firm has received 5 or more Phase II SBIR and/or STTR awards from the Federal Government and the first award was received prior to Jan. 1, 1991, what percentage of your firm's revenues during your last fiscal year is Federal SBIR and/or STTR funding (Phase I and/or II)? ______
- Identify each Phase II SBIR and/or STTR project your firm has received and, for each project, provide the total revenue to date from resulting sales of new products or non-R&D services to DoD or its prime contractors, other government agencies, and private sector customers. Also provide total non-SBIR, non-STTR funding received from government and private sector sources to further develop the SBIR or STTR technology (including R&D, manufacturing, marketing, etc.). Apportion sales revenue and non-SBIR, non-STTR funding among the various Phase II projects without double-counting. (See back for further instruction.)

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ______________________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ______________________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ______________________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ______________________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ______________________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

FIRM CORPORATE OFFICIAL

NAME: ____________________ TELEPHONE: ____________________

TITLE: ____________________ FAX: ____________________

Before signing below, please read the cautionary note at Section 3.7

____________________ ____________

SIGNATURE OF FIRM CORPORATE OFFICIAL DATE

(Page ____ of ____)

INSTRUCTIONS FOR COMPLETING APPENDIX E

General:

The Company Commercialization Report (Appendix E) shall NOT be counted toward proposal page count limitations.

Appendix E should be the last page(s) of your proposal.

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Carefully align the forms in the typewriter using the underlines as a guide.

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Submission:

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Request for Copies:

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DoD SBIR/STTR Support Services
2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFRER (STTR) PROGRAM
COMPANY COMMERCIALIZATION REPORT

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FIRM NAME: ____________________

MAIL ADDRESS: ____________________

____

CITY: ____________________ STATE: __________ ZIP: __________

- How many Phase II SBIR or STTR awards has your firm received from the Federal Government (including DoD)? (The answer "none" will not affect your ability to obtain an STTR award.) __________
- If your firm has received 5 or more Phase II SBIR and/or STTR awards from the Federal Government and the first award was received prior to Jan. 1, 1991, what percentage of your firm's revenues during your last fiscal year is Federal SBIR and/or STTR funding (Phase I and/or II)? __________
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Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

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Agency: __________ Topic Number: __________ Contract Number: __________

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Project Title: ____________________

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Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

Agency: __________ Topic Number: __________ Contract Number: __________

Project Title: ____________________

DoD/Primes Sales: __________ Other Gov't Sales: __________ Private Sector Sales: __________

non-SBIR/STTR Gov't Funds: __________ non-SBIR/STTR Private Sector Funds: __________

FIRM CORPORATE OFFICIAL

NAME: ____________________ TELEPHONE: ____________________

TITLE: ____________________ FAX: ____________________

Before signing below, please read the cautionary note at Section 3.7

____________________ __________

SIGNATURE OF FIRM CORPORATE OFFICIAL DATE

(Page _____ of _____)

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Submission:

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2850 Metro Drive
Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFRER (STTR) PROGRAM COMPANY COMMERCIALIZATION REPORT

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FIRM NAME:____________________

MAIL ADDRESS: ____________________

____

CITY: __________ STATE: ______ ZIP: ______

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Project Title:____________________

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Project Title:____________________

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Agency:______ Topic Number:______ Contract Number:______

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Project Title:____________________

DoD/Primes Sales:______ Other Gov't Sales:______ Private Sector Sales:______

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FIRM CORPORATE OFFICIAL

NAME:__________ TELEPHONE:__________

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Minneapolis, MN 55425-1566
(800) 382-4634

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

ALLOCATION OF RIGHTS IN INTELLECTUAL PROPERTY AND RIGHTS TO CARRY OUT FOLLOW-ON RESEARCH, DEVELOPMENT, OR COMMERCIALIZATION

(This is only a model)

This Agreement between _____, a small business concern organized as a _____ _____ under the laws of _____ and having a principal place of business at _____ _____, ("SBC") and _____, a research institution having a principal place of business at _____, ("RI") is entered into for the purpose of allocating between the parties certain rights relating to an STTR project to be carried out by SBC and RI (hereinafter referred to as the "PARTIES") under an STTR funding agreement that may be awarded by _____ _____ ("AGENCY") to SBC to fund a proposal entitled "_____ _____" submitted, or to be submitted, to AGENCY by SBC on or about _____, 199_.

1. Applicability of this Agreement.

(a) This Agreement shall be applicable only to matters relating to the STTR project referred to in the preamble above.

(b) If a funding agreement for an STTR project is awarded to SBC based upon the STTR proposal referred to in the preamble above, SBC will promptly provide a copy of such funding agreement to RI, and SBC will make a subaward to RI in accordance with the funding agreement, the proposal, and this Agreement. If the terms of such funding agreement appear to be inconsistent with the provisions of this Agreement, the PARTIES will attempt in good faith to resolve any such inconsistencies. However, if such resolution is not achieved within a reasonable period, SBC shall not be obligated to award nor RI to accept the subaward. If a subaward is made by SBC and accepted by RI, this Agreement shall not be applicable to contradict the terms of such subaward or of the funding agreement awarded by AGENCY to SBC except on the grounds of fraud, misrepresentation, or mistake, but shall be considered to resolve ambiguities in the terms of the subaward.

(c) The provisions of this Agreement shall apply to any and all consultants, subcontractors, independent contractors, or other individuals employed by SBC or RI for the purposes of this STTR project.

2. Background Intellectual Property.

(a) "Background Intellectual Property" means property and the legal right therein of either or both parties developed before or independent of this Agreement including inventions, patent applications, patents, copyrights, trademarks, mask works, trade secrets and any information embodying proprietary data such as technical data and computer software.

(b) This Agreement shall not be construed as implying that either party hereto shall have the right to use Background Intellectual Property of the other in connection with this STTR project except as otherwise provided hereunder.

(1) The following Background Intellectual Property of SBC may be used nonexclusively and, except as noted, without compensation by RI in connection with research or development activities for this STTR project (if "none" so state): _____;

(2) The following Background Intellectual Property of RI may be used nonexclusively and, except as noted, without compensation by SBC in connection with research or development activities for this STTR project (if "none" so state): _____;

(3) The following Background Intellectual Property of RI may be used by SBC nonexclusively in connection with commercialization of the results of this STTR project, to the extent that such use is reasonably necessary for practical, efficient and competitive commercialization of such results but not for commercialization independent of the commercialization of such results, subject to any rights of the Government therein and upon the condition that SBC pay to RI, in addition to any other royalty including any royalty specified in the following list, a royalty of __ % of net sales or leases made by or under the authority of SBC of any product or service that embodies, or the manufacture or normal use of which entails the use of, all or any part of such Background Intellectual Property (if "none" so state):_____.

3. Project Intellectual Property.

(a) "Project Intellectual Property" means the legal rights relating to inventions (including Subject Inventions as defined in 37 CFR § 401), patent applications, patents, copyrights, trademarks, mask works, trade secrets and any other legally protectable information, including computer software, first made or generated during the performance of this STTR Agreement.

(b) Except as otherwise provided herein, ownership of Project Intellectual Property shall vest in the party whose personnel conceived the subject matter or first actually reduced the subject matter to practice, and such party may perfect legal protection therein in its own name and at its own expense. Jointly made or generated Project Intellectual Property shall be jointly owned by the PARTIES unless otherwise agreed in writing. The SBC shall have the first option to perfect the rights in jointly made or generated Project Intellectual Property unless otherwise agreed in writing.

(1) The ownership, including rights to any revenues and profits, resulting from any product, process, or other innovation or invention based on the cooperative shall be allocated between the SBC and the RI as follows:
SBC Percent: ____ RI Percent: ____

(2) Expenses and other liabilities associated with the development and marketing of any product, process, or other innovation or invention shall be allocated as follows:
SBC Percent: ____ RI Percent: ____

(c) The PARTIES agree to disclose to each other, in writing, each and every Subject Invention, which may be patentable or otherwise protectable under the United States patent laws in Title 35, United States Code. The PARTIES acknowledge that they will disclose Subject Inventions to each other and the awarding agency within ___ months after their respective inventor(s) first disclose the invention in writing to the person(s) responsible for patent matters of the disclosing Party. All written disclosures of such inventions shall contain sufficient detail of the invention, identification of any statutory bars, and shall be marked confidential, in accordance with 35 U.S.C. § 205.

(d) Each party hereto may use Project Intellectual Property of the other nonexclusively and without compensation in connection with research or development activities for this STTR project, including inclusion in STTR project reports to the AGENCY and proposals to the AGENCY for continued funding of this STTR project through additional phases.

(e) In addition to the Government's rights under the Patent Rights clause of 37 CFR § 401.14, the PARTIES agree that the Government shall have an irrevocable, royalty free, nonexclusive license for any governmental purpose in any Project Intellectual Property.

(f) SBC will have an option to commercialize the Project Intellectual Property of RI, subject to any rights of the Government therein, as follows--

(1) Where Project Intellectual Property of RI is a potentially patentable invention, SBC will have an exclusive option for a license to such invention, for an initial option period of ____ months after such invention has been reported to SBC. SBC may, at its election and subject to the patent expense reimbursement provisions of this section, extend such option for an additional ____ months by giving written notice of such election to RI prior to the expiration of the initial option period. During the period of such option following notice by SBC of election to extend, RI will pursue and maintain any patent protection for the invention requested in writing by SBC and, except with the written consent of SBC or upon the failure of SBC to reimburse patenting expenses as required under this section, will not voluntarily discontinue the pursuit and maintenance of any United States patent protection for the invention initiated by RI or of any patent protection requested by SBC. For any invention for which SBC gives notice of its election to extend the option, SBC will, within ___ days after invoice, reimburse RI for the expenses incurred by RI prior to expiration or termination of the option period in pursuing and maintaining (i) any United States patent protection initiated by RI and (ii) any patent protection requested by SBC. SBC may terminate such option at will by giving written notice to RI, in which case further accrual of reimbursable patenting expenses hereunder, other than prior commitments not practically revocable, will cease upon RI's receipt of such notice. At any time prior to the expiration or termination of an option, SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's patent rights in the invention for SBC to make, use and/or sell products and/or services that embody, or the development, manufacture and/or use of which involves employment of, the invention. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services which embody, or the development, manufacture or use of which involves employment of, the invention; (ii) reimbursement by SBC of expenses incurred by RI in seeking and maintaining patent protection for the invention in countries covered by the license (which reimbursement, as well as any such patent expenses incurred directly by SBC with RI's authorization, insofar as deriving

from RI's interest in such invention, may be offset in full against up to _____ of accrued royalties in excess of any minimum royalties due RI); and, in the case of an exclusive license, (iii) reasonable commercialization milestones and/or minimum royalties.

(2) Where Project Intellectual Property of RI is other than a potentially patentable invention, SBC will have an exclusive option for a license, for an option period extending until ___ months following completion of RI's performance of that phase of this STTR project in which such Project Intellectual Property of RI was developed by RI. SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's interest in the subject matter for SBC to make, use and/or sell products or services which embody, or the development, manufacture and/or use of which involve employment of, such Project Intellectual Property of RI. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services that embody, or the development, manufacture or use of which involves employment of, the Project Intellectual Property of RI and, in the case of an exclusive license, (ii) reasonable commercialization milestones and/or minimum royalties.

(3) Where more than one royalty might otherwise be due in respect of any unit of product or service under a license pursuant to this Agreement, the parties shall in good faith negotiate to ameliorate any effect thereof that would threaten the commercial viability of the affected products or services by providing in such license(s) for a reasonable discount or cap on total royalties due in respect of any such unit.

4. Follow-on Research or Development.

All follow-on work, including any licenses, contracts, subcontracts, sublicenses or arrangements of any type, shall contain appropriate provisions to implement the Project Intellectual Property rights provisions of this agreement and insure that the PARTIES and the Government obtain and retain such rights granted herein in all future resulting research, development, or commercialization work.

5. Confidentiality/Publication.

(a) Background Intellectual Property and Project Intellectual Property of a party, as well as other proprietary or confidential information of a party, disclosed by that party to the other in connection with this STTR project shall be received and held in confidence by the receiving party and, except with the consent of the disclosing party or as permitted under this Agreement, neither used by the receiving party nor disclosed by the receiving party to others, provided that the receiving party has notice that such information is regarded by the disclosing party as proprietary or confidential. However, these confidentiality obligations shall not apply to use or disclosure by the receiving party after such information is or becomes known to the public without breach of this provision or is or becomes known to the receiving party from a source reasonably believed to be independent of the disclosing party or is developed by or for the receiving party independently of its disclosure by the disclosing party.

(b) Subject to the terms of paragraph (a) above, either party may publish its results from this STTR project. However, the publishing party will give a right of refusal to the other party with respect to a proposed publication, as well as a ___ day period in which to review proposed publications and submit comments, which will be given full consideration before publication. Furthermore, upon request of the reviewing party, publication will be deferred for up to ____ additional days for preparation and filing of a patent application which the reviewing party has the right to file or to have filed at its request by the publishing party.

6. Liability.

(a) Each party disclaims all warranties running to the other or through the other to third parties, whether express or implied, including without limitation warranties of merchantability, fitness for a particular purpose, and freedom from infringement, as to any information, result, design, prototype, product or process deriving directly or indirectly and in whole or part from such party in connection with this STTR project.

(b) SBC will indemnify and hold harmless RI with regard to any claims arising in connection with commercialization of the results of this STTR project by or under the authority of SBC. The PARTIES will indemnify and hold harmless the Government with regard to any claims arising in connection with commercialization of the results of this STTR project.

7. Termination.

(a) This agreement may be terminated by either Party upon __ days written notice to the other Party. This agreement may also be terminated by either Party in the event of the failure of the other Party to comply with the terms of this agreement.

(b) In the event of termination by either Party, each Party shall be responsible for its share of the costs incurred through the effective date of termination, as well as its share of the costs incurred after the effective date of termination, and which are related to the termination. The confidentiality, use, and/or non-disclosure obligations of this agreement shall survive any termination of this agreement.

AGREED TO AND ACCEPTED--

Small Business Concern

By:_____ Date:_____

Print name:_____

Title:_____

Research Institution

By:_____ Date:_____

Print name:_____

Title:_____

RECEIPT NOTIFICATION

Proposer: If you wish to be notified that your proposal has been received, please submit this form with a stamped, self-addressed envelope.

Remember to Stamp Your Self-Addressed Envelope!

TO: _____
(Fill in firm name)

_____
(street)

_____
(city, state ZIP)

SUBJECT: STTR Solicitation No. _____

STTR Topic No. _____
(fill in Solicitation and Topic No.)

This is to notify you that your proposal in response to the subject solicitation and topic number has been received by

_____
(Fill in name of organization to which you will send your proposal)

_____ _____
Signature by receiving organization Date

DIRECTORY OF SMALL BUSINESS SPECIALISTS

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DoD Fast Track Guidance

This paper contains DoD's official guidance on what types of relationships between a small company and outside investors in the company qualify as an investment under the SBIR and STTR Fast Track ("Fast Track investment"). It includes specific examples of company-investor relationships that we have been asked about and our official responses on whether these relationships qualify as a Fast Track investment. If you have questions about whether a particular company-investor relationship qualifies, please contact the DoD SBIR/STTR Help Desk (tel. 800/382-4634, fax 800/462-4128, e-mail SBIRHELP@us.teltech.com). The Help Desk will refer any policy or substantive questions to appropriate DoD personnel for an official response.

I. General Guidance on What Qualifies As A "Fast Track Investment"

A. The investor must be an **outside** investor, which may include such entities as another company, a venture capital firm, an individual "angel" investor, a non-SBIR/non-STTR government program, or any combination of the above. It does not include the owners of the small business, their family members, and/or "affiliates" of the small business, as defined in Title 13 of the *Code of Federal Regulations* (C.F.R.), Section 121.103. As discussed in that Section:

B. Concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

C. [We] consider factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists.

1. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, may be treated as one party with such interests aggregated.

D. The **investment** must be an arrangement in which the outside party provides cash to the small company in return for such items as: equity; a share of royalties; rights in the technology; a percentage of profit; an advance purchase order for products resulting from the technology; or any combination of the above.

II. Specific examples of What Does and Does Not Qualify As a "Fast Track Investment"

A. Examples of What Qualifies as an "Outside" Investor"

(1) Can a small company contribute its own internal funds to qualify for the Fast Track?

No. DoD is seeking outside validation of the commercial potential of the company's technology, and therefore requires that the funds come from an outside investor. Also, cash from an outside investor shows up plainly on the company's books and therefore can be more readily verified than a company's own matching contribution.

(2) Company A spins off company B, which wins a phase I SBIR award. Company A then wants to contribute matching funds to qualify company B for the Fast Track. Can A be considered an outside investor for purposes of the Fast Track?

In making our determination of whether company A is an outside investor, we would be guided by the definition of "affiliates" in 13 C.F.R. Sec. 121.103, discussed above. Our presumption is that in this example A and B would be considered "affiliates," and that A would therefore not be an outside investor for purposes of the Fast Track. However, that presumption could be rebutted by showing, for example, that the spin-off occurred several years ago and that A and B do not exercise control over one another, do not have common ownership or management, have different business interests, etc.

(3) Small company S wins a phase I SBIR award. The president of S is a major shareholder in another company Y, which wants to contribute matching funds to qualify S for the Fast Track. Can Y be considered an outside investor?

Our presumption is that Y would not be considered an outside investor. Our determination would be guided by whether the president's stake in Y is large enough that S and Y would be considered "affiliates" under 13 C.F.R. Sec. 121.103. Subsection c of Section 121.103 specifically discusses affiliation based on stock ownership:

c. Affiliation based on stock ownership.

1. A person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock.
2. If two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

If S and Y are found to be affiliates, we would determine that Y is not an outside investor.

(4) Does the outside investor have to be a single entity (e.g., a single venture capital firm) or can it be more than one entity (e.g., two angel investors and a venture capital firm)?

It can be more than one entity.

(5) Small company A contributes matching funds to small company B in order to qualify B for the Fast Track, and, at the same time, B contributes matching funds to A in order to qualify A for the Fast Track. Do A and B qualify as outside investors under the Fast Track?

No. A and B's relationship is such that their investment in each other would not provide outside validation of the commercial potential of their respective SBIR projects. We would therefore not consider them to be outside investors for purposes of the Fast Track.

(6) Can the brother of an employee of small company S contribute funds to qualify S for the Fast Track?

Probably not. Again, we would be guided by the definition of "affiliates" in 13 C.F.R. Sec. 121.103. The brother presumptively would be an affiliate of company S and not an outside investor.

(7) Venture capital firm V currently is a 22 percent shareholder in small company S. Can V invest additional funds in S to qualify S for the Fast Track?

Our presumption is yes. In making our determination, we would be guided by whether V and S are "affiliates," as defined in 13 C.F.R. Sec. 121.103. Section 121.103 provides (in subsection (b)(5)) that a venture capital firm is not affiliated with a company if the venture capital firm does not control the company -- e.g., by owning more than 50 percent of the stock of a small company (prior to its investment under the Fast Track), as described in 13 C.F.R. 107.865. 13 C.F.R. 107.865 can be viewed on the internet at http://www.acq.osd.mil/sadbu/sbir/affil2.htm.

(8) Large company L makes a cash investment in small company S, and then serves as a subcontractor to S on an SBIR project. Can L's investment in S count as a matching contribution for purposes of the Fast Track?

Only L's cash investment net of its subcontracting effort can count as matching funds for purposes of the Fast Track. For example, if L invests $750,000 in S and subcontracts with S for $250,000, only L's net contribution ($500,000) can count as matching funds for purposes of the Fast Track.

(9) Company Y makes a cash investment in small company S for purposes of the Fast Track, and also enters into a separate contract with S under which Y provides certain goods/services to S in return for $500,000. Can Y's cash investment in S count as a matching contribution for purposes of the Fast Track?

As in the previous example, only Y's cash investment net of the $500,000 it receives from S can count as matching funds for purposes of the Fast Track. However, if the separate contract between Y and S pre-dates S's submission of its phase I SBIR proposal, Y's entire cash investment can count as matching funds for purposes of the Fast Track.

(10) A group of investors wishes to invest funds in small company S to qualify S for the Fast Track. One of the investors is the mother of S's president, who wants to contribute $50,000 toward the effort. Can the group's investment in S count as a matching contribution to qualify S for the Fast Track?

The mother's investment of $50,000 does not count, because she is not an outside investor (see item (6) above). Contributions of the other investors can count provided that they meet the other conditions for the Fast Track (e.g., each must be an outside investor).

B. Examples of What Qualifies as an "Investment"

(1) Can a loan from an outside party qualify as an "investment" for purposes of the Fast Track?

No. The rationale behind the Fast Track is that an outside party is betting on the company's success in bringing the technology to market -- not just its ability to repay a loan.

(2) How about a loan that is convertible to equity?

A loan that is convertible to equity at the company's discretion would count as an investment under the following circumstances: (1) the loan is provided by a public entity (e.g., a state agency), or (2) the loan is provided by a private entity, and the SBIR company actually converts the loan to equity before the end of phase I.

(3) Can in-kind contributions from an outside investor count as matching funds under the Fast Track?

No. The matching contribution must be in cash. A cash contribution is a stronger signal of the outside investor's interest in the technology, and can be readily verified.

(4) Can a purchase order from an outside investor count as a matching contribution under the Fast Track?

An advance purchase order for new products resulting from the SBIR project can count as a matching contribution under the Fast Track (assuming the other Fast Track conditions are met).

(5) Can the funds raised from an initial public offering (IPO) count as matching funds for purposes of the Fast Track?

Yes, as long as the offering memo indicates that a portion of the funds from the IPO will pay for work (e.g., R&D, marketing, etc.) that is related to the SBIR project.

(6) If large company L pays small company S for work related to S's SBIR project and expects a deliverable (goods or services) from S in return, would that qualify as an "investment"?

No, for the same reason a loan does not count. Specifically, in this situation the large company is not betting on the small company's success in bringing the technology to market, but merely on its ability to provide the deliverable.

C. Examples Re: Timing/Logistics of the Fast Track Investment

(1) Can entity E's investment in small company S during the first month of S's phase I SBIR project count as a matching contribution to qualify S for the Fast Track?

Yes, provided that E is an outside investor and that the other Fast Track conditions are met. The investment can occur any time after the start of the phase I project.

(2) Small company A, which has won a phase I award, spins off small company B to commercialize the SBIR technology. A then convinces angel investor I to invest funds in B. Can I's investment in B count as a matching contribution to qualify A for the Fast Track?

For I's investment in B to qualify A for the Fast Track, DoD must determine that A and B are substantially the same entity, as evidenced, for example, by their meeting the definition of "affiliates" in 13 C.F.R. Sec.121.103. If DoD determines that A and B are substantially the same entity, I's investment in B could qualify A for the Fast Track. Of course, the parties must also meet the other conditions for the Fast Track (e.g., I must be an outside investor).

(3) Small company S is collaborating with a university on an STTR project. Investor I wishes to provide funds to the university in order to qualify S for the STTR Fast Track. Can I's investment in the university count as a matching contribution to qualify S for the Fast Track?

In order to qualify S for the STTR Fast Track, I's investment of funds must be in small company S, not in the university. S can then subcontract some of the funds to the university. The rationale is that a cash investment in the small company is a very strong indication of commercial potential, whereas an investment in the university is less so.

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